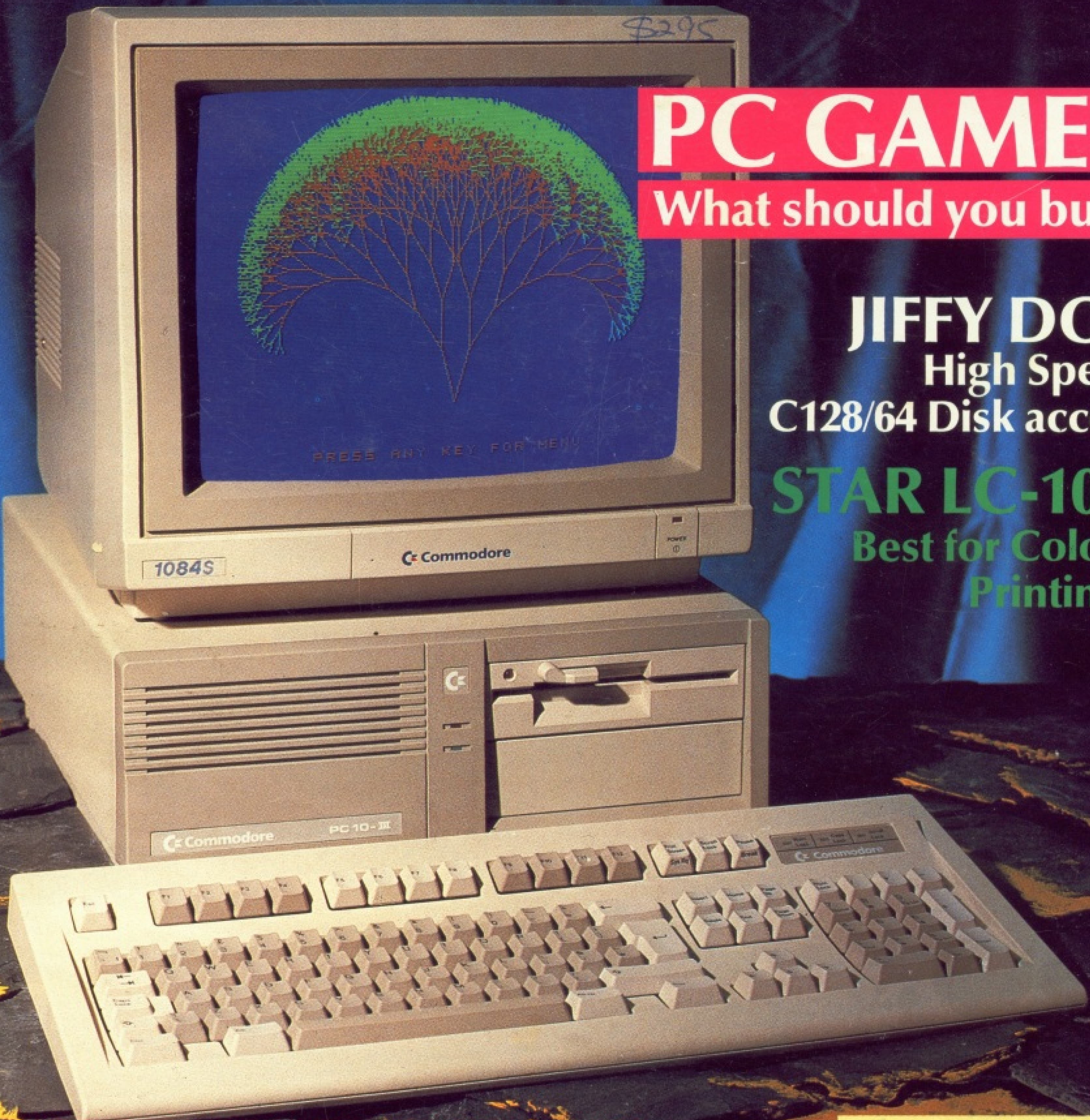
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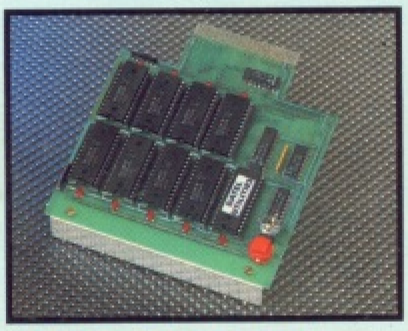
STAR LC-10C
Best for Colour
Printing?

UNBEATABLE PROGRAMS:
- Mouse80
- Quicksearch
- C64 Windows

REVIEWED:
- The Real Ghostbusters
- Para Assault Course
- Demon's Winter
- Las Vegas Casino
- Time Thief

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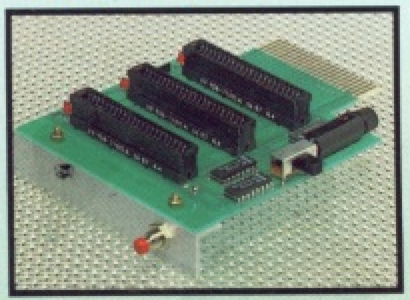
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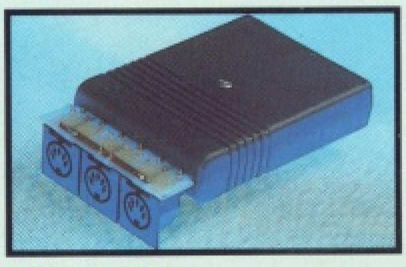


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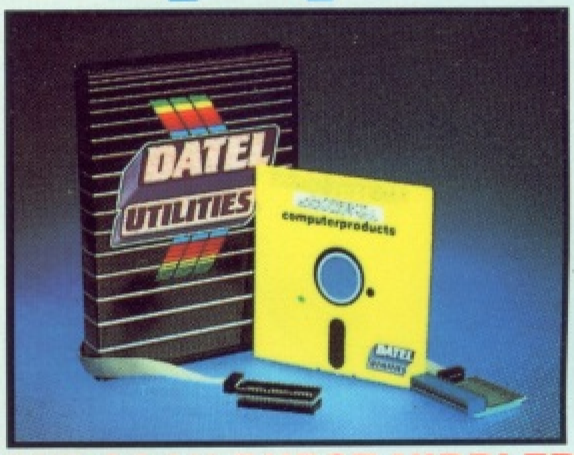
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- ❑ Wether to choose FastHack'em or Burst Nibbler? Fast Hack'em is unbeatable value as an "all rounder" - with nibblers, 1 or 2 drive copy, format, file copy, 1571 copy etc. etc., so if you have a more general requirement perhaps Fast Hack'em is for you. Burst Nibbler is a pure nibbler second to none, for the reasons stated. So if it's just making backups you are interested in, there is no other product to beat it!

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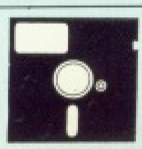
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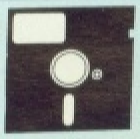
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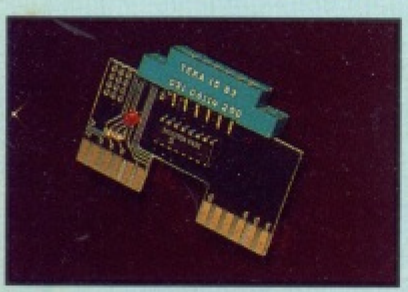


THE ULTIMATE DISK TOOLKIT FOR THE 1540/1541.

- ❑ A disk toolkit is an absolute must for the serious disk hacker. Toolkit IV has more features than most for less.
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- On board TTL logic circuitry actually shapes the program & sends a perfect signal to the record cassette - producing a copy better than the original in many cases.
- L.E.D. indicator shows when data is being transferred to avoid exessive tape winding.
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- Requires access to two CBM compatible data recorders.
- Simply press 'Play" on one recorder & press 'Record' on the other - that's it!
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- This is a total hardware solution - no programs to load - the results are stunning!

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- Improved DOS support including 10 sec. format.
- Programed function keys:- load, directory, old, etc.
- Return to normal kernal at a flick of a switch.
- FCOPY-250 block file copier.
- FLOAD-special I/O loader.
- Plus lots more.
- Fitted in minutes - no soldering usuallly required. (On some 64's the old ROM may have to be desoldered).

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SMART CART

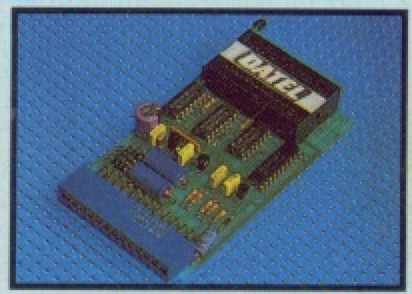
- 32K pseudo ROM.
- Lithium battery lasts up to 5 years.
- Simply load the program you require - then flick the switch. The cartridge can then be removed just like a ROM cartridge.
- Make your own cartridges including autostart types - without EPROM burner. 32K version = 4 x 8K pages.
- Some knowledge of M/C is helpful - but full instructions included.
- I/O 2 slot open for special programing techniques.

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RAM DISK

- Turn your Smart Cart into a 32K Ram/disk.
- 32K of instant storage area for files/programs.
- Disk type commands:- load, save, directory, scratch.
- Program data retained when computer is switched off!
- Full command set with instructions.

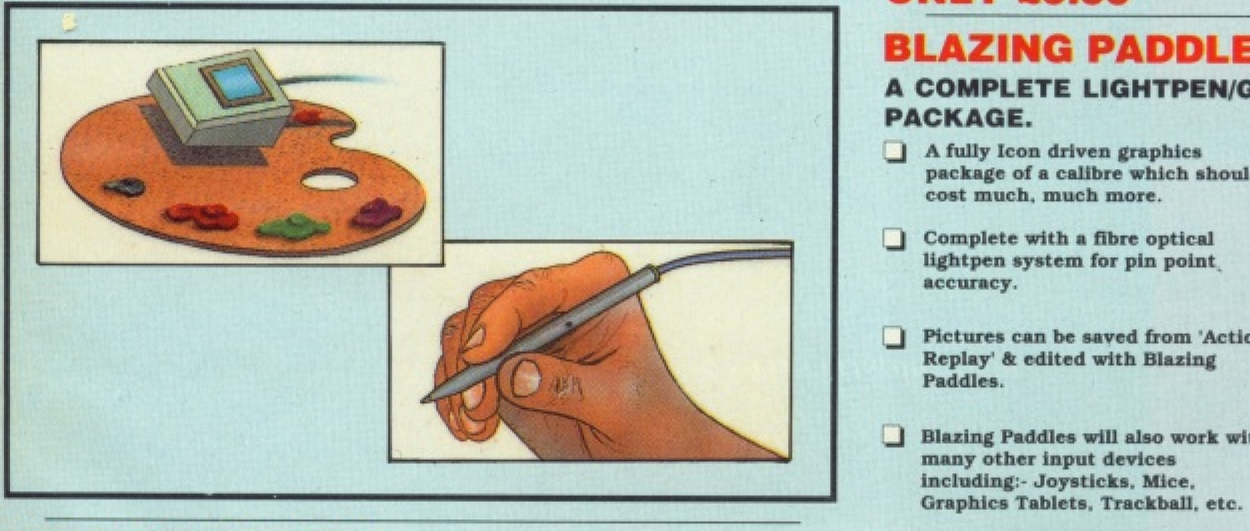
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- A top quality, easy-to-use EPROM programer for the 64/128.
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- Will program 2716, 2764, 27128 & 27256 chips, 12.5, 21 or 25 volts.
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- This drive is now probably the most compatible drive available for the Commodore. More so than even Commodores own '1541C'.
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- At last, a top quality drive at a sensible price.

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- Compacts by up to 30%!
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- Fast loading/saving routines.
- Full DOS support including fast format.

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on cartridge

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- Multi Module Disk Nibbler - all on the one disk.
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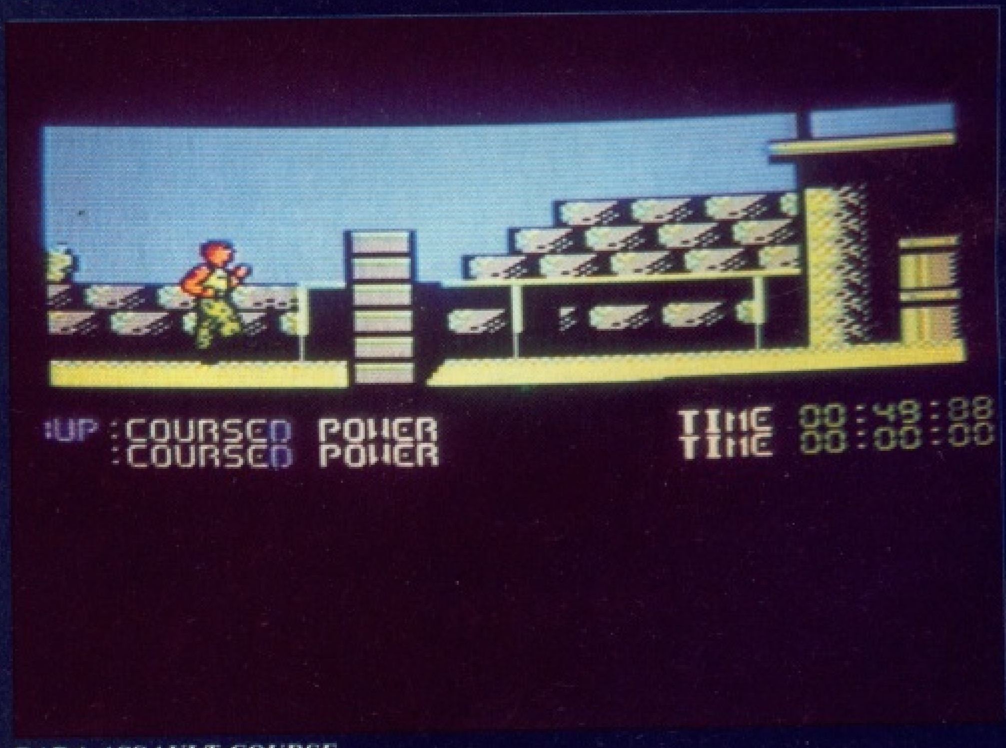
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NUMBER 10**



DEMON'S WINTER



REAL GHOSTBUSTERS



PARA ASSAULT COURSE

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ABC

Data Statements

THE MYTH GOES ON

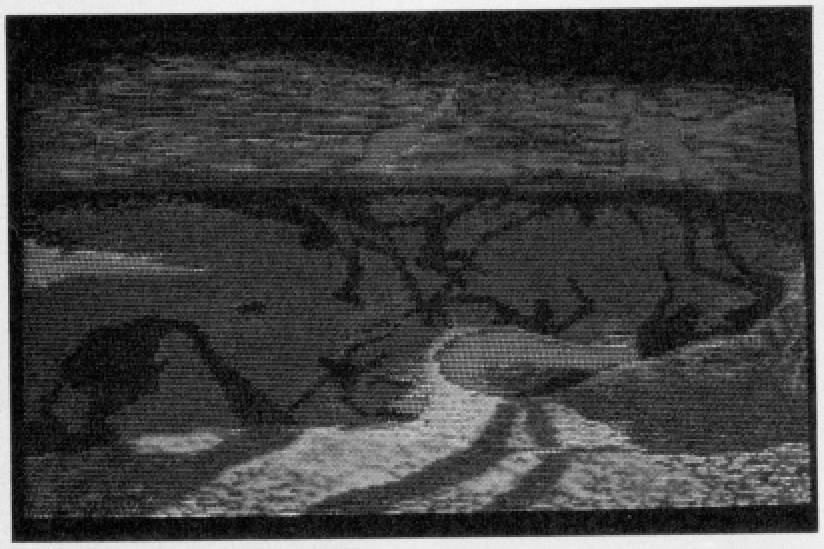
For all members of the Official Secrets: Magnetic Scrolls are about to give you a treat. From the writers of *The Pawn, Corruption* and *The Guild Of Thieves* comes *'Myth'. Myth* is set in ancient Greece, where you play the part of Poseidon, God of the Sea. Your task is not an easy one. Lurking somewhere is 'Helmet of Invisibility'. Your mission Jim should .... (Sorry, wrong program.) Your mission is to find it. A problem? Yes, no, maybe? How do you find something that is invisible? Enough of the plot. Go and get it. 'Myth' will be made available initially for Atari ST, Amiga and Macintosh. Other formats will follow shortly. (C64 and other 8-bit disk only machines).

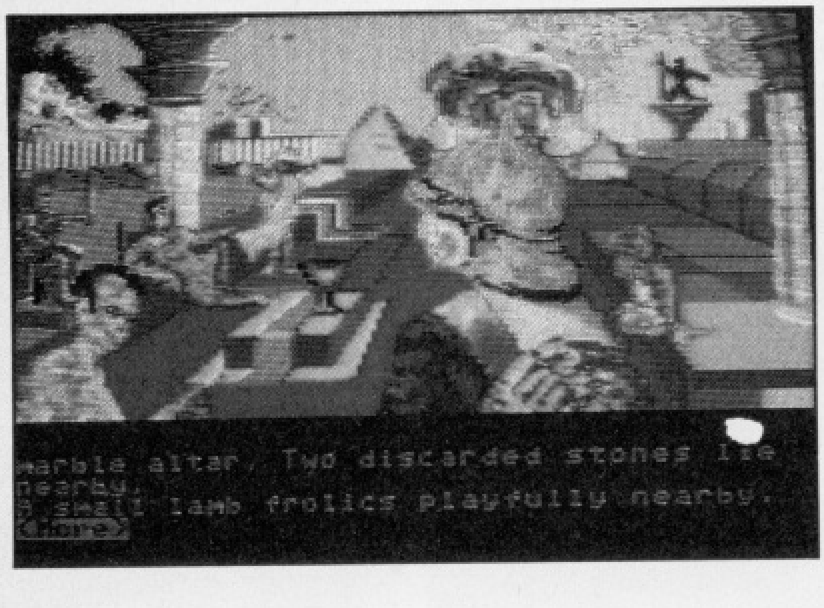
Touchline:
Magnetic Scrolls, 1 Chapel Court, London, SE1 1HH.
***Tel:** 01 403 4325/4268*

THE WORD IS SECURITY

Computer Security Ltd, Britain's largest systems security specialist, will be demonstrating its PC products and systems at the PC User Show. (9-11 May at Olympia). They will be occupying stand number 92A. There will be a variety of products on view, covering such topics as Hacking, Viruses, File-Security, and Electronic Mail protection, etc, etc. For anyone that values their data, this must be worth a visit.

Touchline:
Computer Security Ltd, Olivier House, 18 Marine Parade, Brighton, BN2 1TL.
***Telephone:** 0273 672191.*





JINX OF THE SPHINX

Incentive Software has commissioned exclusively for the Home Computer Club, the fourth freescape 3D game, Total Eclipse II, (The Sphinx Jinx). Your mission is to rebuild the Sphinx that was destroyed in the ancient revolution. You can only do this before the eclipse, which is just 1 hour away. There are 12 parts of the sphinx to collect from the underground network of tunnels and caverns. As an added bonus, the player with the highest score will win for themselves a trip to Hawaii to see a real Total Eclipse. Total Eclipse and Total Eclipse II are available together as a special presentation. The game is available for the Home Computer Club only and costs £11.20 for both disks. The game will be released for the Spectrum, Amstrad CPC and C64.

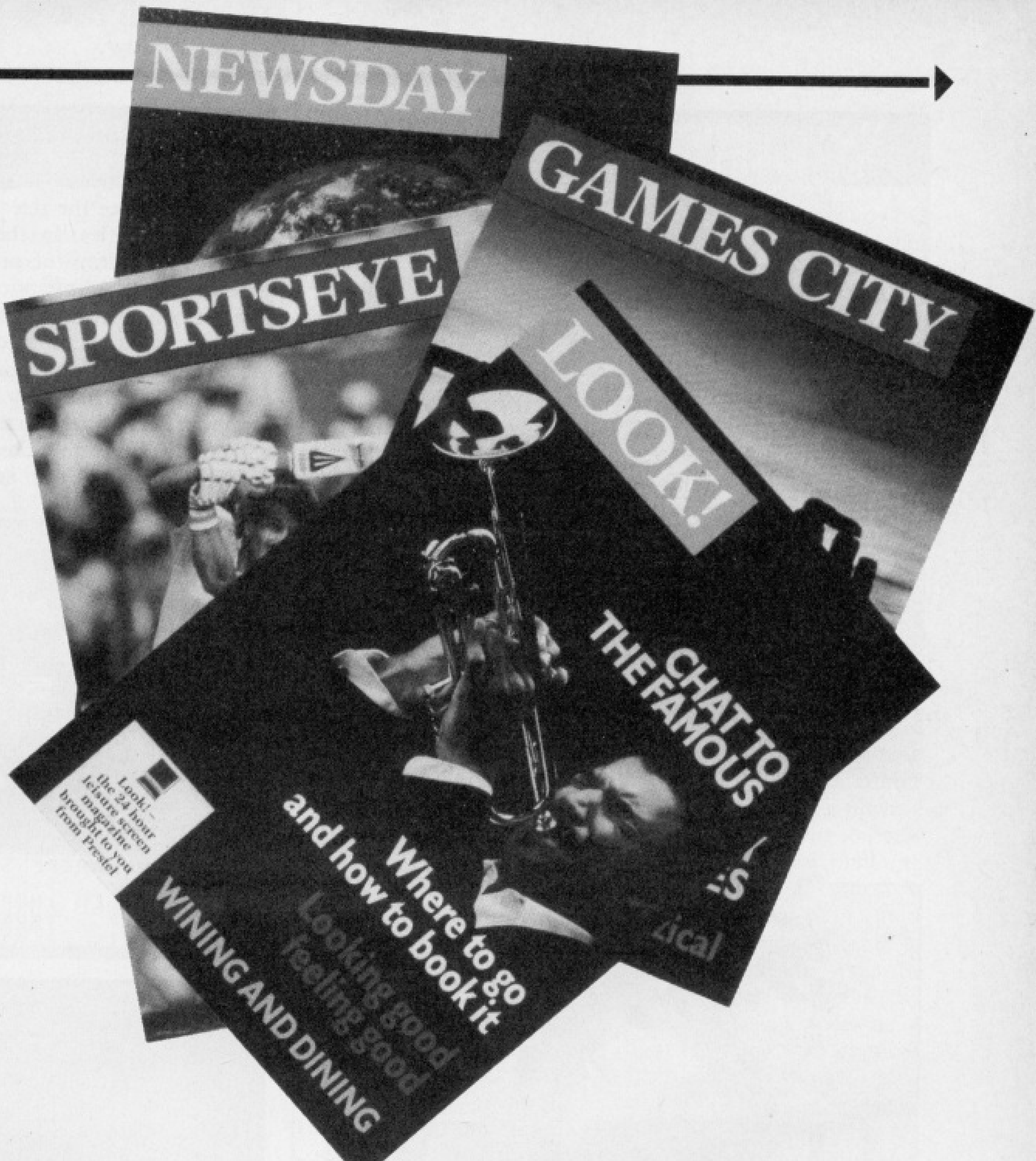
Touchline:
Incentive Software Ltd., Zephyr One, Calleva Park, Aldermaston, Berks, RG7 4QW.
Tel: 07356 77288.

ON SCREEN READING

Following the major changes in the way that Prestel is organised four new on-line leisure magazines have been launched.

The magazines are a response to recent surveys detailing the users' areas of interest. Until now on screen magazines have been rather boring to look at since updating a page always seemed to take ages. John Thomany, General Manager for Prestel Leisure has stated that " Rationalisation of the data base and new regional structures mean that reading the magazine will be as easy as flicking to your favourite page in a newspaper."

The magazines cater for those interested in the latest news, sport, leisure and games.



Newsday gives you up to the minute news, from the Observer, available 24 hours a day. The magazine will feature news headlines updated throughout the day, financial news, and features. Travel features, and weather reports, are provided by AA Roadwatch, and the Met office, while rail users will find the instantly accessible British Rail timetables extremely useful.

Sportseye caters for the armchair sports-person, providing cricket information for all major counties and first class matches, updated every few minutes, with daily news and commentary on every match. Football fans will find fixtures, match previews, results and league tables. Horse racing, motor racing, rugby, American football, golf and other special sporting events will be covered.

In a live link, Sportstalk gives subscribers a chance to interview their favourite sporting personalities.
Add to all of this quizzes, the ability to order sportskit, from the Sportsshop and Sportseye, the Sports Council's database of sports facilities throughout the UK, and you've got what is probably the most comprehensive package available for sports fans everywhere.

Look! is designed to be an entertainment magazine covering travel, health, music, theatre, food and even an agony aunt.

Information for *Look!* is provided by the Consumers Association, British Rail, AA Roadwatch, The National Theatre and Prestel's own Corkers' Wine Guide.

Readers of *Look!* will be able to purchase wine, order tickets and take part in regular interviews with personalities.

Fun 'n' Games City is as its name suggests, dedicated to those who are looking for a little light relief.

The *Pier* has one-armed bandits, side-shows and other games – with cash prizes. Prizes of hi-fi equipment, videos, and records will all be given away in regular quizzes.

Prestel is an on-line database that can be accessed with a modem and a computer with relevant software. Subscription costs £8.00 plus VAT per quarter. An extra connect-time charge is also made of 1p per minute off-peak, and 7p per minute peak.

Contact Dialcom UK, on 0442 237370, for more information.

KNIT 1 PURL 2

Here's a novel idea for all you knitters out there. You know how difficult it is to read those massive patterns. What with their tiny squares and black and white formats. Well, help is now at hand. An enterprising chap from Bradford, Mr Harry Morris, has devised a program for transposing these patterns into a more easily readable form. At the moment, the program is available for the C64, but hopefully other formats will be catered for shortly. To quote Harry, "This programme helps people who want to design their own garments to print out the patterns in a more easily readable form before they start to knit up".

Touchline:
Bradford Enterprise Service, City Hall, Bridge Street, Bradford, W. Yorks, BD1 1HY. ***Tel:*** *0274 753780.*

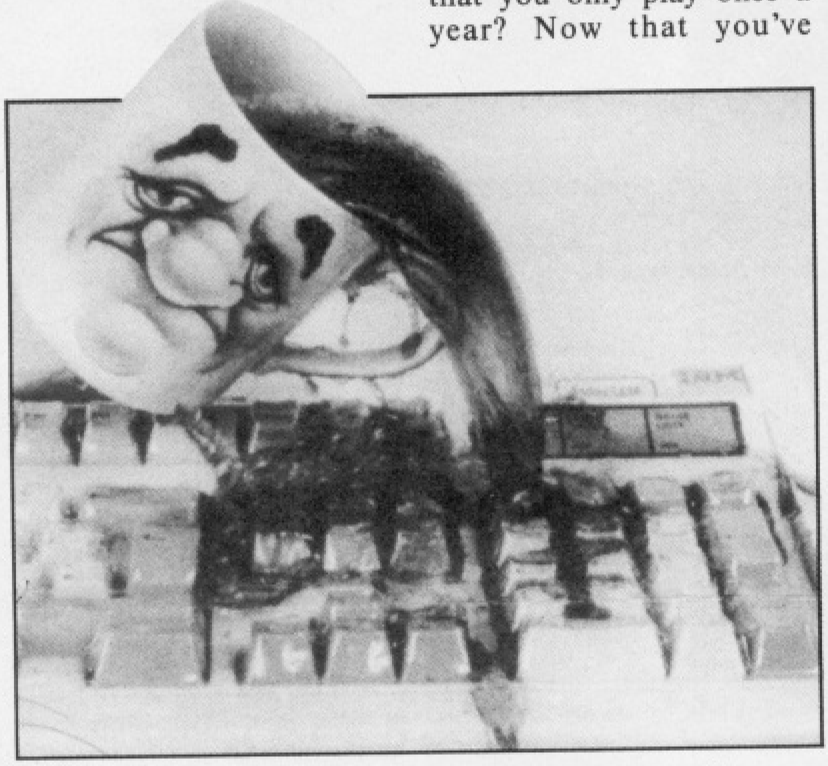
Multi-Lingual Keyboards

Do you wish that your computer keyboard sported symbols for French, Italian, Arabic or even Farsi? You do? Well then you may be interested in the latest product from Kador.

Kador are now offering a range of keytop kits for 10 foreign languages. The keytop kit consists of all the correct characters, diacritical marks, accents and punctuation symbols. The keytops are made from rigid PVC and are simply stuck on to your existing keytops. Prices start at £17.50.

As well as producing multi-lingual keytops Kador also produces a unique keyboard cover, Seal'n'Type. Seal'n'Type is designed to fit securely over each key on your computer keyboard making the keyboard safe from accidental spillages of tea, coffee etc. (I once had to remove spaghetti from someone's C64 – ED). Prices are: C64/C16 £7.50 PC, A500, A1000, A2000 £10.95.

Kador can be contacted at: Unit 4, Pontcynon Industrial Estate, Abercynon, Mid. Glamorgan, CF45 4EP. Tel: 0443 740281.



SOFT CHARITY

This summer, computer owners will be able to pick up some cheap software, and help a major charity at the same time.

OXFAM, Britain's leading overseas aid and development charity, working on emergency relief, and long-term development projects in Africa, Asia, Latin America, and the Middle East, are asking for your software donations throughout June, and July. The majority of the donated software will be sold at selected London shops during a special computer promotion month starting on June 27th.

So, get checking your computer software. Do you really need that shoot-em up that you only play once a year? Now that you've changed your computer what have you done with all of your old software? OXFAM can accept your donations through any of its 900 nationwide shops.

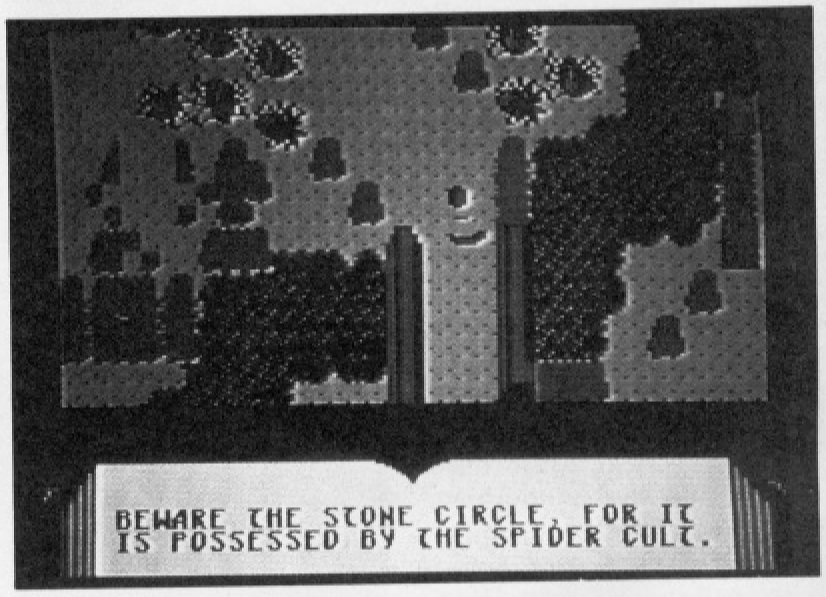
Get along to your local OXFAM shop in June, help yourself to some cheap software, and help someone less fortunate than yourself.

TWO FROM SSG

Strategic Studies Group (SSG) announce the release of two new titles, in their ever growing army of programs. The first, *Gold of the Americas* is an historical strategy game. You know the kind: set up colonies, trade, raid and generally be master of everything you see, and at the same time keep everyone happy. The second, *Fire King,* is an animated adventure. The world is in its usual state of darkness and chaos. During your jaunts through enchanted forests, ancient temples, and burning deserts, you fight off hords.

Release date for these two are planned for the early summer. Gold of the Americas, will be available on PC format at £24.99 and Fire King will be for the C64 at £18.99.





ESPA - A look into the future?

A new body, designed to represent the entertainment software market has recently been launched. ESPA, the Entertainment Software Publishers Association, has been set up in order to promote and stimulate all areas of software games production.

ESPA intends to target TV and consumer media for extensive media coverage trying to promote the benefits and fun offered by computer games. Extensive market research will be carried out to provide members of the association with accurate information about product performance and market trends.

Eighteen of the top software houses have already become founders of ESPA and more are sure to follow suit.

Computer Graphics for Squariels

By now you have all probably heard about the launch of yet another satellite TV service in the UK : British Satellite Broadcasting.

Incentive Software, producers of Freescape 3D graphic programs, have teamed up with BSB and Broadsword, who produced the award-winning TV series Knightmare, to produce a 30 episode series entitled The Satellite Game.

The game will place three youngsters inside a space shuttle to dock with Enigma, an alien satellite, that is threatening to blow up the solar system.

The contestants have to penetrate and defuse the core of the giant satellite by piloting a droid controlled Larry.

Freescape, from Icentive, will be used to give a true 3D representation of the world inside the satellite.

BSB is set to begin broadcasting in September 1989. Three channels will be offered at first. Now, a sports and news service, *Galaxy,* a general entertainment channel, and The Movie Channel, which will offer 6 first-run feature films a week for a subscription of £9.99 per month. For more information contact BSB, 70 Brompton Road, London, SW3 1EY.

The Satellite Game set for launch in January 1990



French Protection

The arguments about radiation, and other nasties from monitor screens affecting the user, is one that seems to go on and on. One minute the manfacturers say there's no problem, then a different company comes up with a new solution to the low-radiation problem we've just been told doesn't exist.

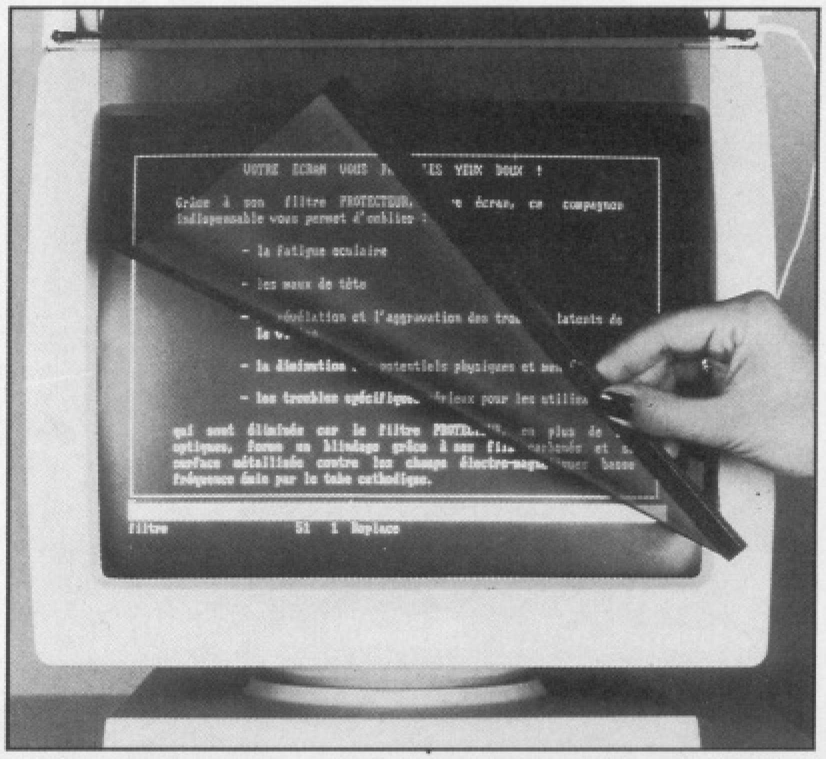
For those who'd rather be safe, than sorry, Aquila Permamesh is a new entry into the protection stakes. The French manufacturers claim that the new screen filter offers a fully effective shield against low-level radiation. The filter also protects against static, screen glare, and screen reflections.

The Aquila permamesh screen shield is designed to fit any monitor and is available in the UK from Accodata.

An Alternative Label

Alternative Software is set to fire yet another budget label into the pocket-money software wars.

The first new program on the label, Winner, will be scrolling shoot-em up, War, which was a very popular game when it was sold at full price. Price point No is just 2.99 for the C64 version.



The Aquila Permamesh protects from screen glare, reflections, static and low-level radiation.

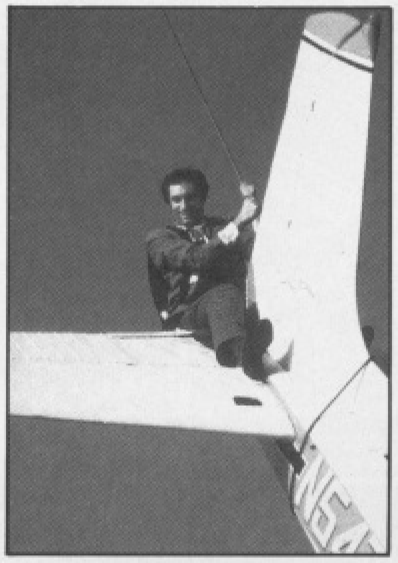
Another Bond Licence

Domark is continuing its series of block-buster related games with the computer version of the latest Bond movie Licence to Kill.

Licence To Kill, The Computer Game, closely follows the plot of the film. In the game you'll take control of 007 in a helicopter chase, an under-water scene and a race to the border as Bond tries to prevent the film baddie Sanchez escaping with a massive haul of drugs.

Licence to Kill will be relased in June for the Amiga, PC and C64.

Licence to Kill set for June release. (c) 1988 DANJAQS. A. All Rights Reserved.



ALL TANGLED UP

A new era of role-playing adventures is about to burst forth. *Origin* are planning the release of a new style RPA entitled 'Tangled Tales', subtitled 'The Misadventures of a Wizard's Apprentice'. We are informed that this will be a light-hearted and comical approach to the usual fantasy RPA.

You are the cast in the role of a wizard's apprentice with three difficult tasks to perform. Scenes consist of haunted houses, medieval fortresses and country farms. The game features menu and icon interfaces, state-of-the-art graphics and an unusually good story line. Tangled Tales will be released for the C64 and IBM PC's and compatibles. As yet, no definite prices have been announced.

Touchline:
Microprose, 2 Market Place, Tetbury, Glos, GL8 8DA.
Tel: *0666 54326*



Gribbly's Special Day Out



This is a Rack-it rerelease of Hewson's *Gribbly Grobbly* game in which you play a one-legged, armless gribbly from the planet Blagor who must bounce around the hostile landscape rounding up the gribblets and returning them to your cave.

Gribbly's are non-violent people as you probably have already guessed (after all they are armless), and possess no weapons except the ability to fire bubbles at the giant spider that lurks on their planet. As the game begins, this creature is locked in a grid, but when this dissolves it is free to roam. To add to your troubles, there are also tube-like worms that flip the gribblets on their backs, where they are vulnerable to attack. You task is to bubble these worms, flip the gribblets over and carry them one by one to your cave.

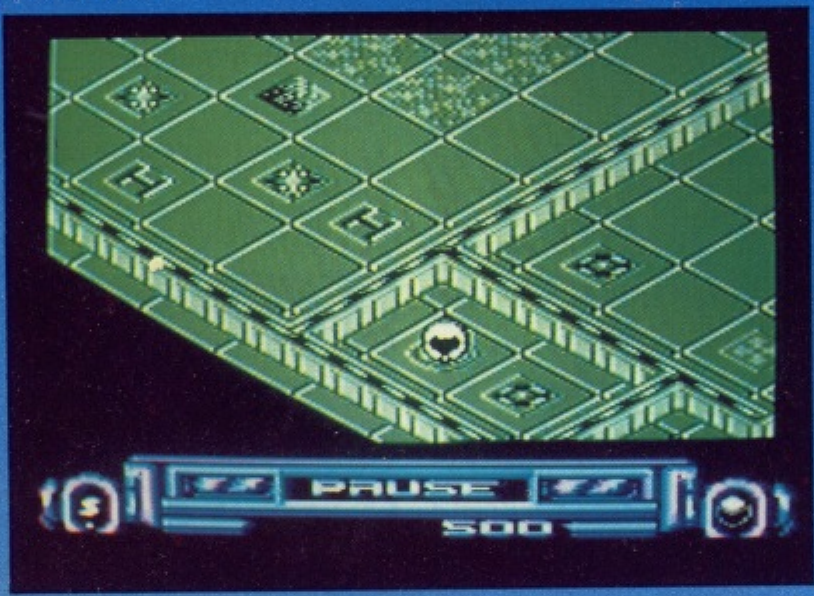
The key to the game is your control of Gribbly, as he can either hop around the ground or fly, but any collisions with the landscape or critters will drain his Psi-energy – this can also be topped up by jumping on a limited number of Psi creatures, which sounds quite painful, but could mean the difference between success and failure.

Gribbly's Special Day Out makes a change from the usual diet of zap-em games, but will appeal to those who appreciate a degree of skill in the game.

Title: *Gribbly's Special Day Out.* ***Supplier:*** *Rack-it (Hewson) 56B Milton Pk., Milton, Abingdon, Oxon OX14 4RX.* ***Tel:*** *(0235) 832939.* ***Price:*** *£???*

Incredible Shrinking Sphere

The Sangfalmadore Run is a planetoid battle training area designed to push new galactic recruits to their limits. Just the thing that a desk-bound Colonel-in-Chief would like to have a shot at. He did and was trapped in the middle of it in the process, and it's your job to go in after him.



You control a fighter sphere, a craft that's probably unique in the field of gaming as you can use tiles in the Run to change the sphere's volume, mass and speed to help you navigate around the maze. Your fighter is also equipped with a 70mm cannon to blast the assassin spheres that have polluted the Run.

The Run consists of a maze of walls, ramps and passageways which is floored with tectonic tiles that have a variety of effects on your fighter. These could provide the answer to an obstacle in your way or become a death trap. These tiles include some that increase or decrease your mass, which affects your ability to move over damaged tiles or to use the fragile ramps, and others that affect your volume, the size of corridor you can traverse and your velocity, which determines your speed and inertia.

The skill of the game is in controlling the fighter sphere to avoid the many traps and assassin spheres and in planning your journey over the tiles so you're the right size and weight for the next stage in the puzzle.

Incredible Shrinking Sphere is one of those games that is difficult to learn and impossible to master, but if you do you will be hooked for hours and hours.

Touchline:
Title: *Incredible Shrinking Sphere.* ***Supplier:*** *Activision, Blake House, Manor Farm Road, Reading, Berks, RG2 0JN* ***Tel:*** *(0734) 311666* ***Machine:*** *C64/128* ***Price:*** *?????*

WEC LE MANS

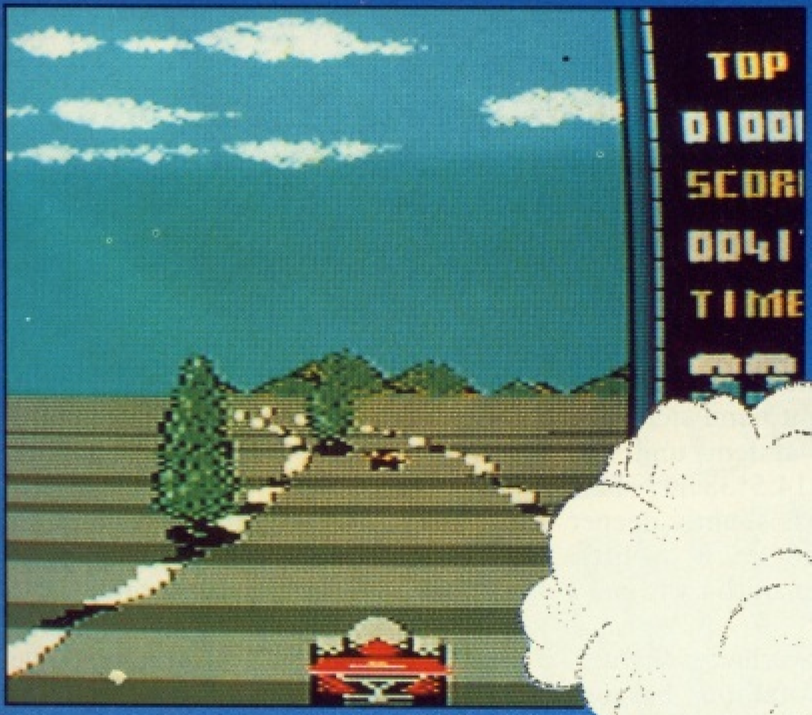
Are you ready for the "ultimate racing experience"? That's how Ocean (via its Imagine label) describes its latest coin-op version of *WEC Le Mans*.

However, once again a C64 is supposed to simulate an arcade machine of the sit-in type that spins you around as you turn the car wheel. Therefore, unless you spend a fortune and build your own arcade system, it will be impossible for it to compete.

Having said that, the C64 ver ion of *Le Mans 24-hour Racing* is somewhat disappointing, as it offers little more than the old-style games, and features your car hurtling along a road that comes out of the screen towards you. The road in question bends and dips and does all it can to send you careering into one of the trees, lamposts or signs that flank it. Your cause isn't helped by the other road users, who fly past you at a phenomenal speed and then slam on their brakes to ram you and send you spinning off the track in a manner that Dick Dastardly would be proud of.

The object of the game is to drive as fast as you can between the track's checkpoints, reaching each one in time to qualify for the next stage. This means keeping your car as close to 220mph as possible. To add to the incentive to drive at breakneck speeds, the game awards bonus points for speeds reached. Since these range from 10 points for



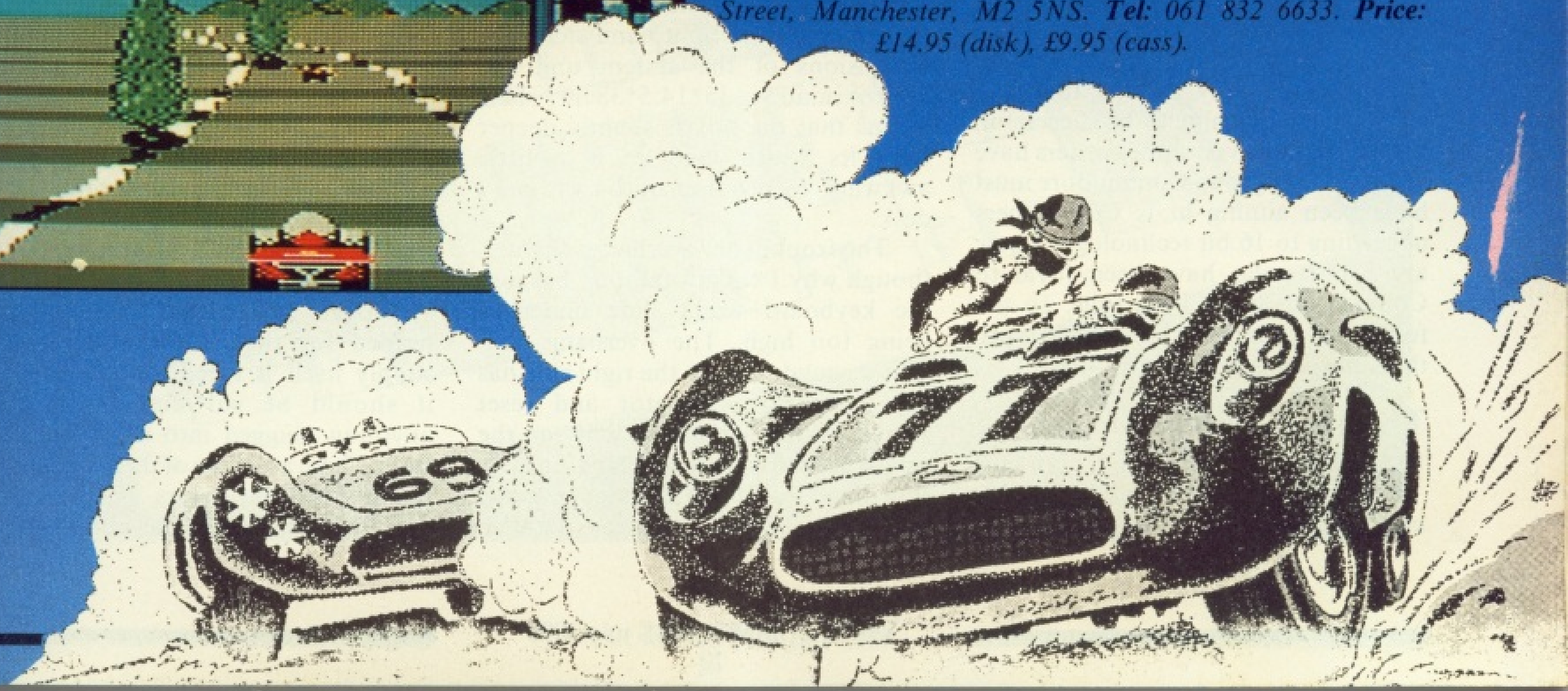


20mph to 80 points for 220mph, it makes sense to keep the accelerator button firmly pressed down.

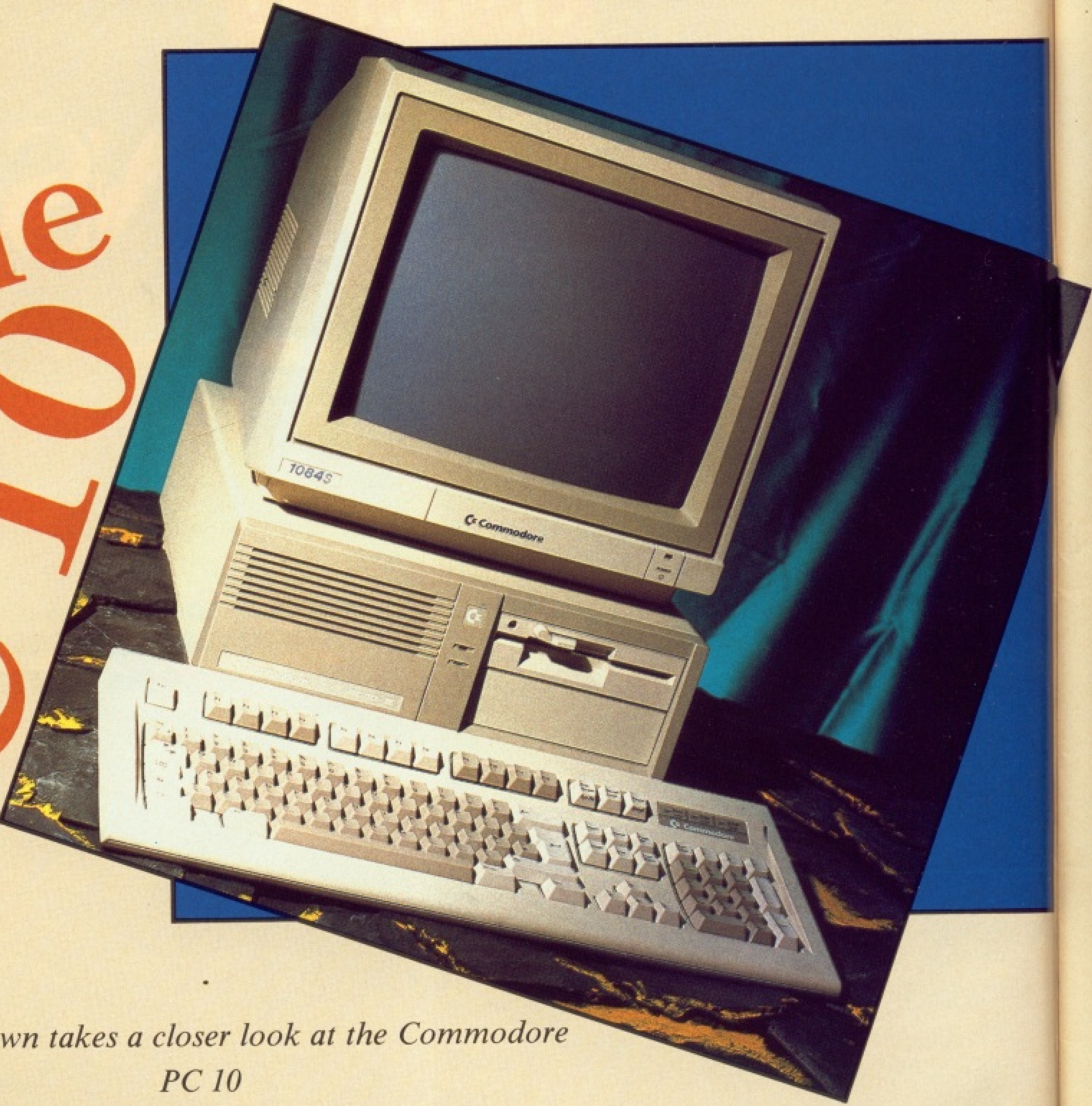
Controls are the obvious steer left and right, accelerate and brake joystick moves, with the firebutton acting like a two position gearstick. This is about the only element of strategy in the game, as you must change gear when the speedometer reads 130mph.

Hurtling along a road at 220mph does have its addictive appeal, particularly when you're racing against the clock, as the game ends if you don't reach the next checkpoint in time. If you do, an "extended play" message appears and the race continues. Perhaps the most infuriating part of the game is that if you don't reach the checkpoint in time, you're forced to retire and are then given a fleeting glimpse of the entire circuit, which shows you just how close you were to finishing. It's infuriating enough to drive you back for more and more.

Touchline:
Title: *WEC Le Mans.* ***Supplier:*** *Imagine (Ocean), 6 Central Street, Manchester, M2 5NS.* ***Tel:*** *061 832 6633.* ***Price:*** *£14.95 (disk), £9.95 (cass).*



The PC 10



Andrew Brown takes a closer look at the Commodore PC 10

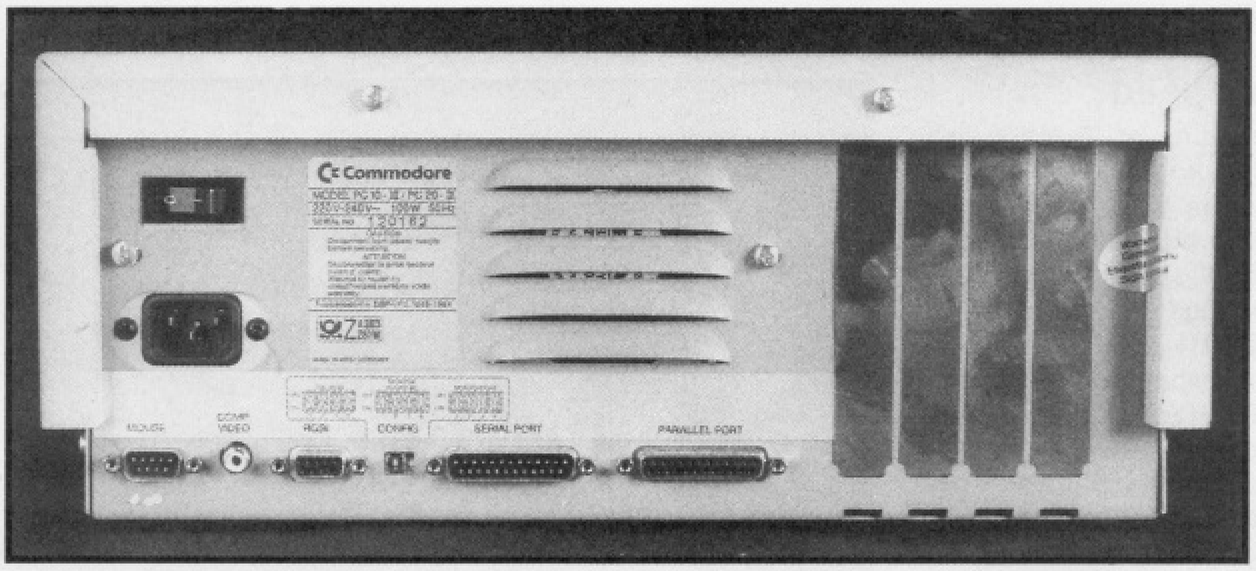
The PC10 is the cheapest machine in Commodore's range of PC-XT compatibles, if you disregard the bargain basement PC1. This is an overcrowded market, so Commodore really needed to get it right for the machine to be successful. Inevitably however, some corners have been cut. One group Commodore must have been aiming at is C64 owners upgrading to 16 bit technology. These are people who have been loyal to Commodore for a long time, so the following comments are made with them particularly in mind.

The Hardware

The PC10 is very much a standard PC, both in terms of looks and internal architecture. It comes as a three box system, with the monitor sitting on top of the system unit, and the keyboard connected by a cable and DIN plug on the right hand side. The dimensions of the system unit are approximately 35*14.5*38cm. This means that the box is slightly deeper than its width, and so is a little awkward to position on an ordinary desk.

The front panel overhangs slightly, though why I cannot fathom, because the keyboard won't slide under it, being too high. The overhang continues round, and on the right side has the keyboard connector and reset switch, which felt very wobbly on the well-travelled review machine. Inspection of the rear of the machine revealed an array of ports, including parallel, serial, mouse, composite video and RGB. Unusually, a set of four DIP switches were also visible. Using these, different monitor types can be selected without having to remove the outer case.

The mouse port allows connection of Commodore's own 1352 mouse, without having to tie up valuable ports or expansion slots. The power switch is also at the back, just above the power-in socket. There was no power-out socket, so at least two plugs are needed for this system. The power supply itself is rated at 75 watts, so it should be sufficient to power anything plugged into the expansion slots. There are three of these, although the aluminium covers at the back suggest four. Given that almost ever-



ything is built into the main board, this should be ample. All the slots are full length, so there should be no problems with bulky items such as hard disks on-a-card.

Externally, everything except the front grille is made of metal, and feels very sturdy. The finish may not be to your taste, being a drab shade of grey, but it will be very durable. Removing the case is just a matter of removing the six fixing screws, and sliding it off. Looking inside reveals the disk drive bays, of which there are three – two floppy, and one hard. The latter mounts to the left of the floppies in a vertical position when present, and also economises on expansion slots by having the controller built onto the main circuit board.

The keyboard is of the now-standard 102 key enhanced type. This differs from the old 84 key type in having the function keys along the top, and a separate cursor area. Amiga 500 and 2000 owners will be familiar with it already, as layout is almost identical. Two nice touches are a cable-tidy, and legs that lock into position positively.

'Feel' is a highly subjective matter, but I think most users will find the action of the keys perfectly adequate. Getting used to the layout will probably prove a problem, and left-handers like myself will not be to enamoured of this layout. Indeed the review machine didn't have the correct system disks. Also the software needed to set the keyboard up was not properly installed, resulting in some strange things happening when keys were pressed. I suspect that if all machines are sent out in the same way, a lot of worried telephone calls will result.

The Monitor supplied was the familiar 1084S monitor, so I won't comment on it here, except to suggest that a stereo monitor is overkill for a simple PC. More interesting is the display adaptor, which can support different kinds of monitor, and hence graphics standards. Colour monitors such as the 1084 will produce CGA graphics, which are more suitable for games. Monochrome monitors can display Hercules graphics, and give 80*25 test with crisp characters. So it's possible to have a dual purpose machine, with monitors for both serious and games applications connected at the same time.



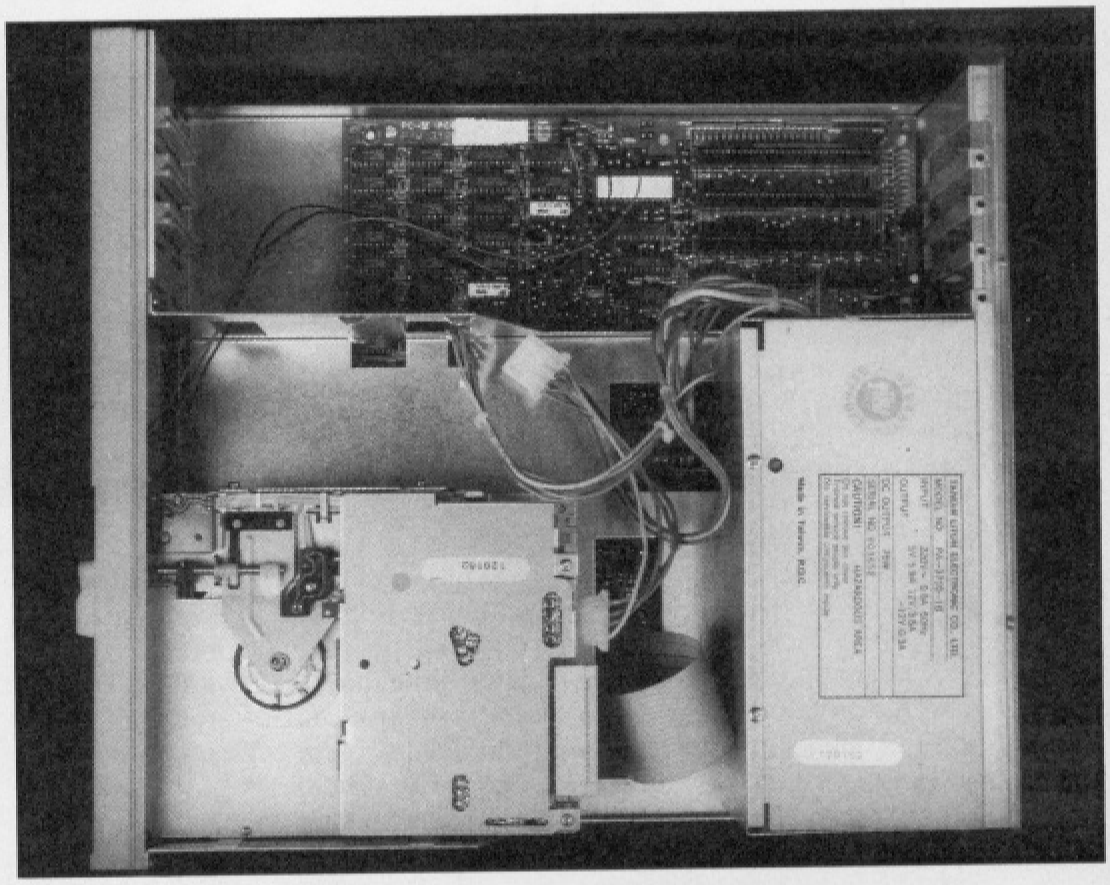
Processor Speed

This is something of an obsession in PC circles, with endless quoting of clock speeds in reviews. However tiresome this can be, it's important to understand that this has a direct bearing on how fast the machine is to use. The PC10 III uses the original 8088 processor, which is the slowest of the Intel 808x family of chips, but clocked at up to 9.54 Mhz. This is double the original speed, and gives very nearly twice the performance. Needless to say, performance is a great improvement on most 8 bit machinery, but not in every way.

In use

Switching the machine on brings a noisy fan to life, and as the display clears, a number of messages appear at the top of the screen. These seem slightly irrelevant, and I wonder if a better course of action would be to access them from a set up program. You then have to boot MSDos by inserting a system disk. The process is very similar to running Workbench on an Amiga, but when it's done, all you get is just a plain A: prompt. The machine arrives running at the 4.77Mhz (slow) processor speed at switch on. To change speeds, you have to press three keys at once, or use the speed utility supplied. This is just plain silly, and could lose Commodore sales in the showroom. After all, in the kind of places where this machine is competing, sales people are unlikely to have sussed things out sufficiently to change it.

The PC10 will run all the software you'd expect – that is, everything barring packages requiring a hard disc, or EGA standard graphics adaptor. Surprisingly though, changing the processor's clock speed doesn't make much difference to the computer. On reflection however, it's not so odd, as the limiting factor on most computer programs is the speed of the operator, not the machine. Only the benchmarks really show the greater processing power achieved, but even benchmarks should be taken with a pinch of salt. In the end, a computer is a productivity tool, and whether the one you buy meets your needs is the only question that must be answered. As a pointer though, a PC-XT compatible, like the PC10, should be sufficient for most home and general use.



Documentation

As befits a plain vanilla computer, the PC10 comes with plain documentation. Three manuals are provided, two of which (for MSDos and GWBasic) are standard Microsoft issue. As such they are perfectly adequate, but not very friendly to new users. The third, and slimmest volume is the Users Manual. This does attempt to make the introduction to MSDos a little less panic inducing. It is however, let down by the standard of production, featuring as it does nasty line drawings and fuzzy photographs. Also the manual veers into discussing low-level programming, something I would rather see put into a technical reference manual. It is worth bearing in mind though, that after the initial set-up, most people will have no further need for this manual.

Conclusion

Comparing the Commodore PC10 with its nearest competitor, the Amstrad PC1512, reveals few glaring deficiencies in either. The Amstrad is cheaper, but the Commodore has a better display, and so on. It might in the end come down to who offers the better bundling deal. At the moment Commodore are bundling a printer – the MPS1230 – with every PC10III. That, in my book, just about swings it.



Graphics on the 64

Part two of our introduction to Graphics programming on the C64

Last month, I began describing the manipulation of graphics on the 64. Due to the lack of space, however, I had to leave two important aspects untouched.

Firstly, there's the small matter of bit-mapped graphics. Last month, I described how you can redefine a character's shape. If you could fill the screen with 1,000 different redefined characters, you could manipulate the whole display in any way you wanted.

Unfortunately, you only have access to 256 characters under normal circumstances. But fear not, the VIC chip offers a solution – bit 5 of register $D011 allows the activation of a bitmap mode. Type in the following command and see what happens:

```
POKE 53265, PEEK(53265) OR 32
```

You should then have a screen full of jumbled rubbish, the top half comprising lines and random dots, the bottom half comprising the full character set. Clear the screen and type some random characters. The character colour should change where each character is placed, and you should see a flashing cursor.

What you have now is a view of the block of ram from memory location 0 to 8191. The flickering at the top of the screen is the changing of zero page locations by the operating system. The normal screen memory is used to provide the character and background colours, and the memory from 0 to 8191 defines the dot patterns.

If you want to use bit map mode, you'll need to use a more suitable memory area. The easiest option, if you're using small Basic programs and you don't want to move Basic, is to select the block of memory from 8192 to 16192. You do this by tweaking the memory register as before. Press RUN/STOP and RESTORE to reset the display, and type in the following:

```
10 POKE 53265,PEEK(53265) OR 32
20 POKE 53272,PEEK(53272) OR 8
30 FOR I = 0 TO 7999
40 POKE 8192+I,0
50 NEXT I
```

This time you get a more regular display, which is progressively cleared. Lines 30 to 50 clear the bit map by inserting zero bytes. Replace line 40 with the following, and see what happens:

```
40 POKE 8192+I,RND(1)*256
```

You can see that by changing the memory block, you can change the bit map. As I said before, the screen memory defines the colours of the bitmap. The bottom four bits of each screen location specify the background colour, and the top four bits define the character colour.

Imagine that you want a white background and a yellow foreground – the value for white is 1 (binary 0001), the value for yellow 7 (binary 0111). Combine them, and we get 01110001 or 113. Add the following lines to the above program, and see the effect:

```
60 FOR I = 0 TO 999
70 POKE 1024+I,113
80 NEXT I
```

Voila! The required colour combination is obtained.

As before, two resolutions are available, depending on the value of bit 4 of register $D016. To set high resolution bitmap with a horizontal resolution of 320 dots, you use:

```
POKE 53270,PEEK(53270)AND239
```

To set multicolour bitmap you use:

```
POKE 53270,PEEK(53270)OR16
```

Both modes have a verticle resolution of 200 dots. But how do we control which dot is set or cleared? Assume you want to set a dot with a horizontal position of X, and a vertical resolution of Y. The following subroutine will set this dot:

```
60000 C=INT(X/8): R=INT(Y/8): BI=7-(X AND 7)
60010 BY=8192+R*320+8*C+(Y AND 7)
60020 POKE BY,PEEK(BY) OR (2^BI)
60030 RETURN
```

To erase a dot replace line 60020 with:

```
60020 POKE BY.PEEK(BY) AND 255-(2^BI)
```

Try the above subroutine with the following program:

```
10 POKE 53265,PEEK(53265) OR 32
20 POKE 53272,PEEK(53272) OR 8
30 FOR I = 0 TO 7999
40 POKE 8192+I,0
50 NEXT I
60 FOR I = 0 TO 999
70 POKE 1024+I,1
80 NEXT I
90 FOR X=0 TO 100
100 Y=X: GOSUB 60000
110 NEXT X
120 END
```

This time, line 70 sets the background colour to white, and the foreground colour to black. The program should draw a diagonal line from the top left hand corner.

Multicolour mode uses the same dot pair system as characters to determine which colours are used. The

colours are determined in the following way:

BIT PATTERN	COLOUR SOURCE
00	$D021
01	Upper 4 bits of screen memory
10	Lower 4 bits of screen memory
11	Lower 4 bits of colour RAM

You will have noticed that bit map routines are very slow. Multicolour mode is even more so, since you need to handle pairs of dots. For successful use of bitmap graphics, it's necessary to access assembler routines for drawing.

The final area needing comment is the use of sprites. A sprite is a block of graphical information, rather like a character, which can be placed anywhere on the screen. A sprite consists of a square block 24 dots wide and 21 characters high. Each row uses 3 bytes, so that each sprite requires 3 x 21 bytes of memory. The VIC chip has a set of registers which determine how sprites are handled. All you need to do is insert the correct values in the relevant registers.

First, we must set up a pattern. You *can* design a sprite in a manner analogous to that used by characters, but it's a bit more difficult. It's far better to use a sprite designer. The sprite patterns are sought in blocks of 64 bytes, starting at memory location 0. Sprite pattern 0 occupies memory locations 0 to 63, pattern 1 occupies 64 to 127, and so on. You can use the following formula to determine the start address of sprite pattern x:

```
address = x*64+bank start address
```

Since the VIC chip is looking at a specific memory bank, this address is really offset from the start address of the bank. Since the default bank for Basic is bank 0, the bank start address is 0. Since the 64 is an eight bit machine, only 8 sprites are supported. The VIC chip finds the sprite pattern from a block of eight sprite pointers. These are located 1016 bytes after the start of the video memory. In the default set up, the pointers therefore start at 1024+1016 or 2040.

The pattern for sprite 0 is held in the first pointer, the pattern for sprite 1 in the second pointer, and so on. If you want to set up sprite 0 to the pattern held at location 12288, you set the sprite pointer as follows:

```
Pattern number = 12288/64 = 192

POKE 2040, 192
```

Rather like the character set, you may not use the area in bank 0 which is occupied by the character ROM image. It is also impractical to use the system area in zero page ram. The useable block is from 8192 to 14336, for example, blocks 128 to 255.

The next step is to position your sprite. The useful screen area occupies a horizontal (X) position from X=24 to X=344, and a vertical position (Y) from Y=50 to Y=240. Each sprite has a register for its vertical position. Since the horizontal position can be larger than 255, two registers are used. Each sprite has a register for the low byte of its X position, and there's a single register for the high bytes of the X positions. The registers are found from:

```
Y register = 53249 + Sprite No * 2
X low byte register = 53248 + Sprite No * 2
X high byte register = 53264
```

Before we move on, we must consider how a register holds sprite data. Each sprite has a specific bit which determines how an attribute is set. Sprite 0 uses bit 0, sprite 5 uses bit 5, and so on.

Using the above relationship, the following routine will set up a sprite's position. X and Y are the sprite's position, and SN is the sprite's number:

```
10 POKE 53249+SN*2,Y
20 HB=INT(X/256)
30 POKE 53248+SN*2,X-HB*256
40 IF HB=0 THEN 60
50 POKE 53264,PEEK(53264)OR2^SN:GOTO 70
60 POKE 53264,PEEK(53264)AND(255-2^SN)
```

Lines 50 and 60 show the way of toggling bits in sprite registers. Line 50 turns the bit on, and line 60 turns it off. This approach is used with the other registers. Table 1 summarises the sprite registers – for each, you apply the following relationships:

```
Turn on bit   POKE REGNO,PEEK(REGNO)OR2^SN

Turn off bit  POKE REGNO, PEEK(REGNO) AN
```

TABLE 1

REGNO	FUNCTION
53269	Turn sprite on or off
53276	Toggle high-res/multicolour modes
53277	Expand sprite in X direction
53271	Expand sprite in Y direction
53275	Sprite priority

The priority register determines the position of the sprite relative to the screen contents. If the relevant bit is set, the sprite is behind the screen contents. If the bit is cleared, the sprite is in front of the screen contents. Sprite to sprite priorities are determined by the sprite number. Sprite 7 is rearmost and sprite 0 is foremost on the screen.

As with characters, you have the option of using single colour high resolution sprites or four colour high resolution sprites or four colour multicolour sprites. There are eight colour registers which specify the high resolution colour. They are found by using:

```
Colour reg = 53287 + SN
```

Multicolour mode uses bit pairs and the colours are derived in the following way:

BIT PATTERN	COLOUR SOURCE
00	$D021
01	$D025
10	Colour register
11	$D026

When using sprites, you may want to detect whether they collide with other screen contents. Two sprite collision registers are used.

Register 53278 detects collisions between sprites. The bits relevant to the sprites involved are set if there is a collision. If, for example, sprites 0 and 5 collide, then bits 0 and 5 are set. When you read this register to decide if the collision has occurred, the register is automatically cleared.

Register 53279 detects collisions between sprites and the characters on the screen. It functions in the same way as the sprite-to-sprite collision register.

Well, that's the theory. Next time, I'll give a set of assembly routines which will take some of the bother out of using graphics on the 64.

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Jiffy Dos

Can the Jiffy defeat the dolphin?

By S. Garton

The combination of C64 and disk drive has often been described as a lumbering hippo, the reason for this being that disk access is extremely slow. A good indication of just how slow a C64 drive is, is that many games load quicker from cassette than from disk – silly, isn't it?

There are a variety of options available to disk users to help speed up disk access and loading time. These are:

Software fast loader
Cartridge
Replacement DOS

The first method of disk speeding is OK when it works. But often, clashes between the memory used by a fast loader and the program you're trying to load prevent such a speed up system being used. Another problem is that a fast loader for one make of drive will not necessarily work on a different Commodore drive.

A cartridge-based fast loader usually gives a better chance of loading a program than the software method, since many cartridges take up little or no user RAM. However, there are problems. Firstly, you have to plug them in to your machine when you want to use them, and, despite warnings, many people have damaged their computers by plugging in or unplugging cartridges while the machine is switched on.

Secondly, some cartridges require you to load fast load software into them, so by the time you've loaded the software in, you may as well have loaded the program in slow mode anyway. Still other cartridges require that you freeze, or copy, the program. Unfortunately, not all programs can be frozen.

The third method of disk speed-up is, to my mind, the best. A replacement DOS system usually requires you to open up both your disk drive and C64 or C128, remove some chips and add new ones containing the new disk access software. Two such systems are currently available. Firstly, there is Dolphin DOS, which has been around for some time. Now there is a new system on offer called Jiffy DOS.

I've been using Dolphin Dos for sime time now, and am particularly happy with it. Dolphin DOS not only replaces chips inside the computer, but a new lead is used for communication between drive and computer. However, this lead plugs into the user port at the rear of the computer, which is a real inconvenience at times, since I use this port for other things, such as my modem.

Since I'm so pleased with Dolphin Dos, I was at first reluctant to try out the new replacement DOS system from Financial Systems Software – Jiffy DOS. However when I did, I was pleasantly surprised by what was on offer.

What You Get

One great problem with Dolphin DOS is that it will only work with my 1541 disk drive. I have a second drive, but this is an Excelerator, and I've been unable to find a fast DOS system to work with this. Until now that is – Jiffy DOS is available for all of the following computers and disk drives:

C64, 64C, SX-64, C128, C128D, 1541, 1541C, 1541-II, 1571, 1581, FSD-1, FSD-2, Excelerator+, Excel 2001, as well as some others.

The fact that you've probably never heard of some of these disk drives will probably indicate to you that Jiffy DOS is of American origin. The originators of Jiffy DOS in the States are Creative Micro Designs Inc. As you can see from the extensive list above, this replacement DOS is available for a much wider range of systems than any other system available.

The first thing that I noticed about Jiffy DOS was the lack of parts to it

– gone are the complicated boards and leads that I associate with my Dolphin DOS. If you have a C64, you simply get two chips with switches attached. If you have a C128, you get three chips, two of them connected to a single switch. One of these chips is the replacement ROM to go inside your disk drive. The other chip (or chips), is a replacement ROM for the KERNAL chip (or chips), inside your computer.

Installation of the new chips is both quick and simple – all that is needed is a screwdriver and a little common sense. Clear, step by step installation instructions are included in the package.

What It Does

Jiffy DOS is designed to speed up all disk operations, including LOAD, SAVE, FORMAT etc. The package claims increases of up to 15 times the speed of a standard drive. A DOS wedge is included in the new chips. This adds 14 new commands to Basic which give you much quicker access to your disks. Single key LOAD, SAVE, and directory commands are also added.

If you have a C128 then the DOS works in both C64 and C128 modes. Rather than spouting on about all of the commands that are offered by Jiffy Dos, I've listed all of the new commands in Figure 1.

If you want to see just how well Jiffy DOS performed, then you should check out Figure 2. Please note these figures are for a C128 with an Excelerator disk drive. Other combinations may give different results.

How Was It?

So what did I think of Jiffy DOS? The lack of a parallel cable was the first good point I noticed. I could have my drive where I wanted it, serial cable allowing, rather than wherever a short parallel lead dictated I have it. Secondly, the ability to use a smaller Excelerator drive rather than my bulky 1541 was of great benefit.

On the software side, I found that most programs that I tried worked without any problems, though some heavily protected software would not load without me disabling the new DOS.

Disabling the DOS simply required that the switches mentioned be turned off. Jiffy DOS can be switched in and out while the computer is still on. This has the advantage that should a program not load while the DOS was turned on, I could simply switch it off. Once the program had loaded, I could turn the DOS back on in order to speed up any further disk activity.

Dolphin DOS presents C128 owners with a slight problem – if the C128 Kernal is replaced, then you lose the ability to load software from cassette tape. If you should ever need to use tape in C128 mode, you'd have to open up the machine and put your old Kernal back in. Flicking the Jiffy DOS switch turns the DOS completely off, and tape use is then allowed, a great benefit for C128 users who require tape.

Of course Jiffy DOS isn't all a bed of roses, and there are a number of areas where I feel Dolphin DOS has the edge on it. For starters I did miss being able to access the monitor that's built into Dolphin DOS. The machine code monitor that Dolphin DOS provides may only be a simple one, but it does come in handy at times.

Dolphin DOS is quicker than Jiffy DOS, and having used Dolphin DOS for some time, I did sometimes find myself waiting for something to load. The cheaper price of Jiffy DOS and its ability to work with just about any system configuration does make it an excellent product. Dolphin DOS offers a few more facilities, but does limit you to the type of disk drive you can use.

Being a C128 user who quite often needs to use a cassette recorder in 128 mode, uses the user port for plugging a number of items into the computer and requires quick disk access, Jiffy DOS does everything that I require, and would be my choice over Dolphin DOS, even if it isn't quite as fast.

Touchline:
Product: *Jiffy Dos.* ***Supplier:*** *F.S.S.L. 18 High Street, Pershore, Worcs WR10 1BG.* ***Tel:*** *(0386) 553153.* ***Price:*** *£54.95.*

Command Summary

Standard DOS 5.1 Wedge Commands	
@	Read the disk drive error channel
@C:newfile=file	Copy a file on the same diskette
@I	Initialize the disk drive
@N:diskname,ID	Format (NEW) a diskette
@N:diskname	Short NEW
@Q	Disable the JiffyDOS commands
@R:newname=oldname	Rename a file
@S:file1[,file2]...	Scratch a file (or files)
@UJ	Reset the disk drive
@V	Validate a disk
@$	Display the disk directory
@#device	Set the default device number
/filename	Load a BASIC program
↑filename	Load and run a BASIC program
%filename	Load an ML program
←filename	Save a BASIC program
Additional JiffyDOS Commands	
@B	Disable/Enable the 1541 head rattle
@D:filename	List a BASIC program from disk
@F	Disable/Enable the function keys
@L:filename	Lock/Unlock a file
@T:filename	List an ASCII file from disk
@U	Un-NEW a BASIC program
!filename	Load an ML file (reset pointers)
&filename	Load an ML file (no pointers reset)
£filename	Load and run an ML file
'filename	Verify a file
<Shift-RUN/STOP>	Load & run first program on disk
<Control-P>	Screen dump
SYS 58451	Re-enable the JiffyDOS commands (C-64, SX-64, C-128 in 64 mode)
SYS 65137	Re-enable the JiffyDOS commands (C-128 in 128 mode)
<Control-D>	Default drive toggle

Mouse 80

Do you own a C128 and a mouse? Then here's the utility to use them together in 80-column text mode

By D.H. Faber

When I recently purchased a mouse (Commodore 1351), I was not too surprised to find that the accompanying software contained a C128 mousedriver for the 40 column mode only. After all, the 8563 VDC chip (or 8568 in the newer models with 64K video ram) does not support sprites, and its complicated access method doesn't help in creating software sprites either!

However, I intended to use my new acquisition mainly in my own programs for the selection of options (or filenames, etc.) from the 80 column screen. If you have similar needs, the utility MOUSE80 described below is the answer. If you don't own a mouse, please read on anyway, because joystick control is also provided!

How it works

At this point, let's assume you've already spent some time typing in the programs (see: "getting it in"), and you have the machine code utility MOUSE80 and the basic demo program DEMOMOUSE80.BAS at hand. Let's combine an X-ray of the utility's inner life with some action on your part! Connect the mouse to either port (if no mouse signals are detected on port 1 then port 2 is tested), or, if you don't have a mouse plug in a joystick instead (if no mouse signals are detected on either port, then joystick control is assumed; note that these tests occur within the MOUSE80 utility itself, not in the demo program).

Now load and run DEMOMOUSE80. BAS (tape users beware: the first thing it wants to do is load MOUSE80). If all is well, you'll see a screen with lines numbered from 0 to 27, using various colours for each line (if you – like me – have to make do with a monochrome halftone you'll see one additional halftone only).

On the upper half of the screen, the two character sets are displayed, the lower half shows a.o. some options that can be selected. The mouse's cursor takes the shape of an arrow, initially situated somewhere in the lower region of the screen. (MOUSE80 was written for the Commodore 1351 mouse; since I cannot vouch for the compatibility of other brands, you'll have to try them for yourself).

Feel free to move the arrow around, but don't press any buttons yet! Joystick users will note that the arrow accelerates as the movement continues, its speed is doubled with each of the four available "gears"; with a proportional mouse there's no need for such acceleration.

Notice anything funny on the fourth line? There are six adjacent characters showing fragments of the arrow and the characters it is currently moving over. This has to do with the way the soft-sprite is generated: the cursor (arrow) affects up to six character positions; the bit patterns are taken from the character set, the sprite is overlaid and the six "reserved" characters are used to display the "sprited" ones.

This process is repeated continuously until one of the mouse buttons (or the fire button of the joystick) is pressed. The six characters sacrificed for this purpose are rather obscure ones: REVERSE+CBM+Y/U/O/H/J/L (screen display codes 244-249 in the graphic set).

This is no great loss, especially since the same characters are still available in the alternative set. Anyway, if you don't like the choice you can select a different set of six adjacent characters to be sacrificed for this purpose (see below).

Two more things are noticeable about the arrow's movement. Firstly, it doesn't leave the screen area. In the vicinity of the borders it even changes direction to be able to point at the borders "from within". Secondly, although it moves pixel-by-pixel in a vertical direction, in horizontal direction it moves two pixels at a time.

This was done not out of necessity, but for practical reasons only: it reduces the required mouse-movement, which otherwise would be twice as large horizontally as for the 40-column screen. Also, this utility was not designed for graphical packages, so greater accuracy would be superfluous.

Now, avoiding the "selection areas" for the time being, try "clicking" on various places on the screen. In the right-hand bottom corner of the screen, you may read at what position exactly you clicked. Here the character positions are counted from zero onwards (as in Basic's CHAR instruction). Note that the maximum pix value in horizontal direction is 638 instead of 639, since the arrow points to the leftmost point of a pair of pixels (see above).

What happens is that after pressing a button, control is returned to the calling program, which can then examine the latest cursor position and decide what to do next (if not on an OPTION area, continue with the arrow in the same position). The calling program can also detect which button (in case a mouse is used) was pressed (see below). This demo program treats both buttons alike.

You may have noticed that the arrow takes on the colour of the characters it is displayed on, unlike the normal cursor which temporarily "paints" the character it is on. There exists another possibility however: try clicking on MONOCHROME. This results in a screen in one colour only, but some characters are now looking weird.

What's happened? If the ATR-bit in register 25 of the VDC is turned off, then the foreground colour is taken from the left nibble of register 26 and not from the attributes. However, the processor doesn't look at the attributes for the characterset bit either! Instead, for all characters the graphic set is assumed. Therefore, if you want to use the monochrome mode, build your option screen with characters from the graphic set only (you may consider swapping the sets in video ram to use characters from the other set instead).

One more remark on this: the colour used for the monochrome

option is the one used in the most recent PRINT statement as stored in location 241 ($F1). You may also poke the desired colour code directly into this location.

To continue our guided tour, click on COLOR to restore the multicoloured screen. Up to now we've used a steady arrow. If you feel it's difficult at times to locate its position, especially on a crowded part of the screen, try clicking on BLINK FASTER and BLINK SLOWER. You'll find that you may choose between a steady cursor (speed=0) and one that blinks slowly (speed=15) to quickly (speed=1). This option can also be easily initiated from the calling program when using MOUSE80 (see below).

Before ending the demo by clicking QUIT, some more remarks are in order. The VDC must be in 80-column mode, 8*8 pixels pro character (as on power-up). You may change the start addresses of screen, attributes and character sets, and you may also change the number of lines displayed. If you're not sure how to do this, it may help to consult the listing of the demo program.

For the sake of completeness: MOUSE80 is not wedged into the IRQ routine as is usually done with mouse drivers. The reason is to be found in the VDC's complicated access method. Changing or reading the contents of a location in video ram (or even a register) requires a multitude of machine code instructions, and another program trying to access the VDC can easily corrupt some of its contents, with unpredictable results. Therefore MOUSE80 returns control only after a mouse button has been pressed; in the meantime it even inhibits interrupts to avoid keyboard interference.

In use

The machine code file MOUSE80 loads from $E000 to $E9E0 in RAM 0 (the area from $E9E0 to $EA6F is used as a scratch pad). From BASIC the mousedriver is called as:

```
BANK0:SYS57344,A,X,Y
```

The Meaning of the parameters A, X and Y (which are transferred to the accu, X-register and Y-register respectively) is as follows:

X = horizontal character position at which the sprite will first appear (0-79).

Y = idem vertical character position. Normal range 0-24 or higher if you changed the number of lines displayed.

Note that the parameters are not checked! A special case is X=Y=255: the sprite will reappear at the same spot it was in when the previous call to MOUSE80 returned control to the calling program. This is useful to restart the driver if you click on an irrelevant part of the screen.

A = blink speed. 0 for no blink, 1 to 15 for fast to slow blink. If A<16 the mouse driver operates in colour-mode. To use monochrome mode add 128 to the value of A; the colour used is taken from the most recent PRINT statement or may be poked directly to location 241 (=$F1).

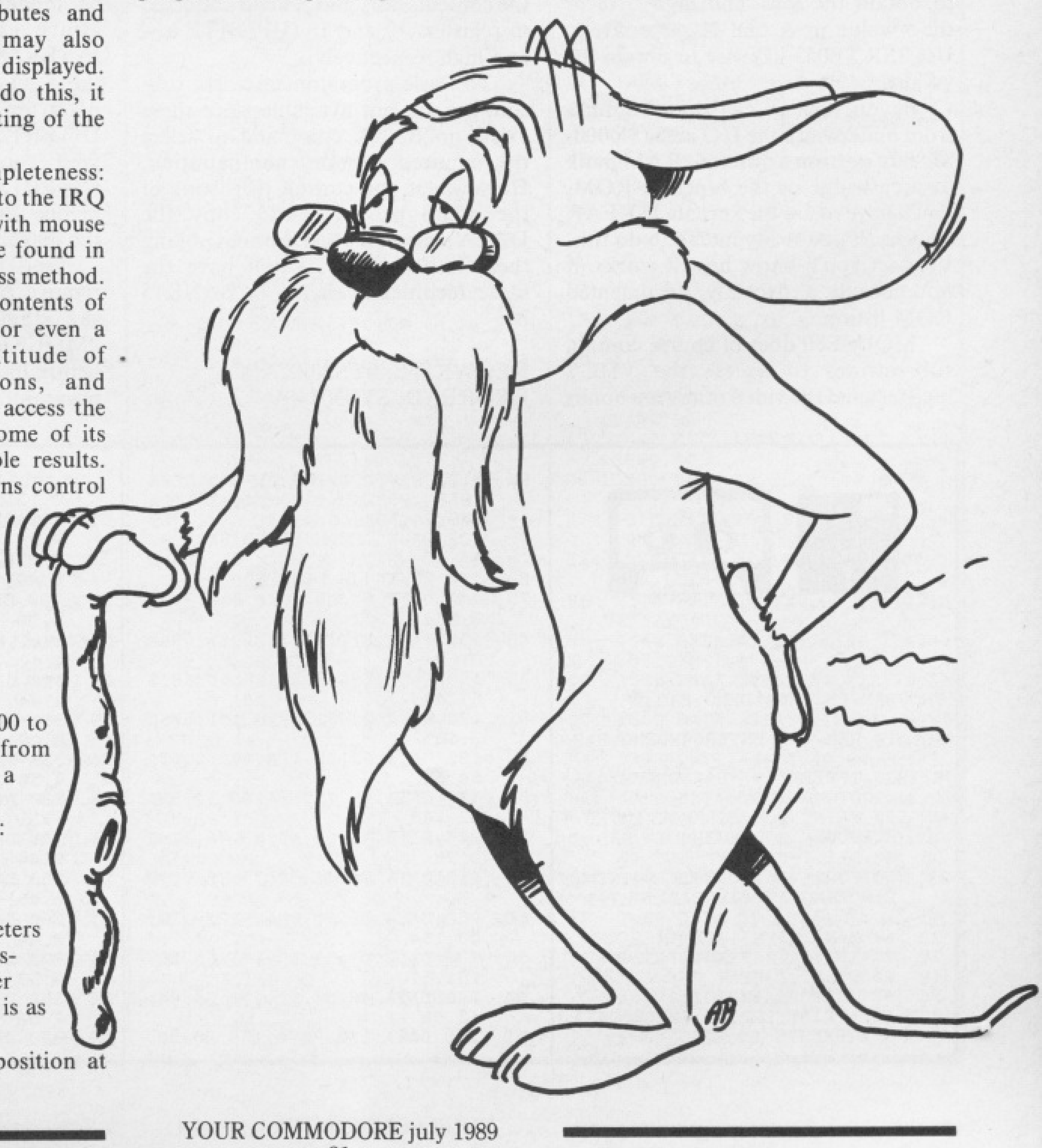
Control is returned to the calling program after pressing one of the mouse buttons (or the fire button of a joystick). Relevant information is stored in registers A, X and Y. To obtain these values use:

```
RREG A,X,Y
```

(A) Is zero if the left mouse button was pressed, 1 for the right button (its value is irrelevant for a joystick). The values of X and Y are the horizontal and vertical character positions respectively at which the arrow was pointing. You may find the exact pixel values as follows:

```
BANKO
SYS57402:RREG A,X:XPIX = A + 256*X
SYS57427:RREG A,X:YPIX = A + 256*X
```

If you want to sacrifice different characters to generate the soft sprite,



you should:

POKE the screen display code of the first one to location $E9DE (=59870); the default value is 244.
POKE the characterset (0 or 1) to location $E9DF (=59871); default is 0 (the graphic set).

For ASSEMBLER programmers: you may call the driver from anywhere in RAMO below $D000.

```
LDA # $3F
STA $FF00
(set A, X, Y as above)
JSR $E000
```

On return A, X and Y contain values whose meaning is as described above. To obtain the exact pixel location of the arrow use:

```
LDA # $3F
STA $FF00
JSR $E03A
```

to obtain the low- and high byte of the x-value in A and X respectively. Use JSR $E053 likewise to obtain the y-value.

If you wish to call these routines from underneath the I/O area ($D000-$E000), or from a different RAM bank or a cartridge or the function ROM, you'll have to use the kernals JSRFAR routine. If you really intend to do this, I expect you'll know how it works, if not consult a decently documented ROM listing.

MOUSE80 does of course contain subroutines to access the VDC's registers and the video ram. As a bonus to assembler programmers, here's how to use them for your own purposes.

Assuming the calling program is in RAMO and not underneath the I/O area, you must select a bank with RAMO and the I/O components:

```
LDA # $3E
STA $FF00
```

(from $D000-$E000 or from other banks you must use JSRFAR, see above). You can now use five subroutines as follows:

REGWRITE : JSR $E003 (A,X) – value X is stored in register A
REGREAD : JSR $E00F (A) – value of register A is stored in A
VDCWRITE : JSR $E01B (A,X,Y) – value Y is stored in video ram at A/X (low/high byte)
VDCREAD : JSR $E025 (A,X) – the value in video ram (A/X = low/high byte) is transferred to A
SETUPDATE : JSR $E02D (A,X) – the contents of A and X are transferred to registers 19 and 18 (UPDATE low and high respectively).

To Basic programmers, these subroutines are not available since there exists no BANK command to select the required memory configuration. However, if you consult the listing of the demo program and copy the DATA statements and the lines poking them into memory, you'll have the same facilities available in BANK15 by:

REGWRITE: SYS3072,A,X
REGREAD: SYS3084,A
VDCWRITE: SYS3096,A,X,Y
VDCREAD: SYS3106,A,X
SETUPDATE: SYS3114,A,X

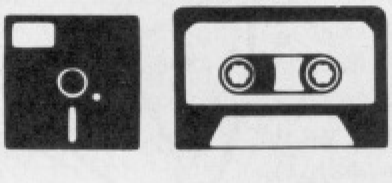
Getting it in

In the listings you'll find the two Basic loaders ENTER64/DEMO.BAS and ENTER64/INTER. Enter and save these using YC's syntax checker (in 64 the following pokes:

mode!). Next (still in 64 mode), enter POKE43, 81:POKE44,41:POKE 10576,0 and LOAD "ENTER64/DEMO.BAS",8 (or 1 for tape users; they should also change 8 to 1 in line 120 of the program). Now run it: the Basic program DEMOMOUSE80.BAS is written to disk (or tape), ready to be used in 128 mode.

Next type "NEW" and (again in 64 mode) enter the same pokes as above and LOAD"ENTER64/INTER",8 (tape users should change the 8 to 1, also in line 110 of the program) and run it: it saves INTER128 to disk or tape. Now restart your computer in 128 mode, load INTER128 (tape users: change 8 to 1 in line 10) and run it: this produces the machine code file MOUSE80.

One final note for tape users: remove the BLOAD from line 10 of the demo program and LOAD "MOUSE 80",1,1 in direct mode before loading and running the demo program!



PROGRAM:ENTER64/DEMO.BAS

```
9D  10 REM --- ENTER64/DEMO.BAS
    ---
E2  20 IFPEEK(43)=81ANDPEEK(44)=
    41GOTO40
0F  30 PRINT"YOU DID NOT ENTER T
    HE POKES CORRECTLY !":END
D6  40 M=1:T=0
BC  50 FORI=7169TO10572:PRINT"[U
    P]POKING AT:"I:READA:T=T+A*M

22  60 M=M+1:IFM>10THENM=1
28  70 IFT>32000THENT=T-32000
C9  80 POKEI,A:NEXT
F6  90 IFT=29843GOTO110
0C  100 PRINT"ERROR: CHECK DATA
    STATEMENTS !":END
BC  110 PRINT"SAVING DEMOMOUSE80
    .BAS":POKE43,1:POKE44,28:POK
    E45,76:POKE46,41
F5  120 SAVE"DEMOMOUSE80.BAS",8,
    1
23  130 POKE44,8:NEW:END
75  140 DATA 64,28,10,0,254,37,5
    8,254
08  150 DATA 17,34,67,72,69,69,8
    3,69
AD  160 DATA 56,48,34,44,66,48,5
    8,254
B2  170 DATA 2,49,53,58,151,50,5
    3,54
FD  180 DATA 52,44,194,40,50,53,
    54,52
8F  190 DATA 41,175,50,53,52,58,
    32,143
EC  200 DATA 32,66,65,83,46,32,7
    3,78
71  210 DATA 84,46,32,79,70,70,0
    ,92
1E  220 DATA 28,20,0,129,73,178,
    48,164
5D  230 DATA 53,52,58,135,65,58,
    151,51
84  240 DATA 48,55,50,170,73,44,
    65,58
01  250 DATA 130,73,0,156,28,30,
    0,131
C1  260 DATA 32,49,52,49,44,48,4
    4,50
38  270 DATA 49,52,44,52,52,44,4
    8,44
98  280 DATA 50,49,52,44,49,54,4
    4,50
C5  290 DATA 53,49,44,49,52,50,4
    4,49
86  300 DATA 44,50,49,52,44,57,5
    4,44
09  310 DATA 49,52,49,44,48,44,5
    0,49
26  320 DATA 52,44,52,52,44,48,4
    4,50
83  330 DATA 49,52,0,220,28,40,0
    ,131
01  340 DATA 32,49,54,44,50,53,4
    9,44
D0  350 DATA 49,55,51,44,49,44,5
    0,49
31  360 DATA 52,44,57,54,44,51,5
    0,44
51  370 DATA 52,50,44,49,50,44,4
    9,53
8E  380 DATA 50,44,49,55,48,44,4
    9,54
80  390 DATA 57,44,51,49,44,55,5
```

```
    4,44
85  400 DATA 48,44,49,50,44,51,5
    0,44
82  410 DATA 52,50,0,30,29,50,0,
    131
03  420 DATA 32,49,50,44,49,54,5
    7,44
A6  430 DATA 51,49,44,55,54,44,4
    9,50
70  440 DATA 44,49,50,44,55,50,4
    4,49
04  450 DATA 54,57,44,49,56,44,5
    1,50
CF  460 DATA 44,48,44,49,50,44,4
    9,48
E6  470 DATA 52,44,49,55,48,44,4
    9,54
B4  480 DATA 57,44,49,57,44,55,5
    4,44
66  490 DATA 48,44,49,50,0,36,29
    ,60
44  500 DATA 0,143,0,66,29,70,0,
    143
06  510 DATA 32,45,45,45,32,50,5
    6,32
0A  520 DATA 76,73,78,69,83,32,8
    3,67
A8  530 DATA 82,69,69,78,32,45,4
    5,45
A7  540 DATA 0,72,29,80,0,143,0,
    138
00  550 DATA 29,90,0,158,51,48,5
    5,50
10  560 DATA 44,50,54,44,48,58,1
    58,51
60  570 DATA 48,56,52,44,50,53,5
    8,254
37  580 DATA 9,65,58,158,51,48,5
    5,50
0B  590 DATA 44,50,53,44,65,175,
    49,57
43  600 DATA 49,58,32,32,32,32,3
    2,32
96  610 DATA 32,32,32,143,32,32,
    83,67
77  620 DATA 82,69,69,78,32,79,7
    0,70
F0  630 DATA 0,205,29,100,0,158,
    51,48
D0  640 DATA 55,50,44,54,44,50,5
    6,58
FD  650 DATA 158,51,48,55,50,44,
    50,48
49  660 DATA 44,49,54,58,151,50,
    54,48
45  670 DATA 55,44,49,54,58,232,
    58,32
1D  680 DATA 32,32,32,32,32,32,3
    2,32
78  690 DATA 32,32,143,32,32,78,
    69,87
35  700 DATA 32,65,84,84,82,32,8
    3,84
91  710 DATA 65,82,84,0,248,29,1
    10,0
4E  720 DATA 153,34,12,34,199,40
    ,49,52
2C  730 DATA 50,41,34,158,176,34
    ,59,58
E1  740 DATA 129,73,178,49,164,5
    5,56,58
E3  750 DATA 153,34,192,34,59,58
    ,130,73
CB  760 DATA 58,153,34,174,34,59
    ,0,66
23  770 DATA 30,120,0,153,34,194
    ,28,32
D4  780 DATA 84,72,69,83,69,32,8
    4,72
36  790 DATA 82,69,69,32,76,73,7
    8,69
E5  800 DATA 83,32,68,69,77,79,7
    8,83
7C  810 DATA 84,82,65,84,69,32,8
    4,72
67  820 DATA 65,84,32,84,72,69,3
    2,77
3C  830 DATA 79,85,83,69,32,34,5
    9,58
3F  840 DATA 143,32,32,80,82,73,
    78,84
08  850 DATA 32,51,32,76,73,78,6
    9,83
D9  860 DATA 0,109,30,130,0,153,
    34,68
C2  870 DATA 82,73,86,69,82,32,6
    7,65
55  880 DATA 78,32,72,65,78,68,7
    6,69
42  890 DATA 32,79,86,69,82,32,5
    0,53
10  900 DATA 32,76,73,78,69,83,1
    58,32
1A  910 DATA 194,34,59,0,142,30,
    140,0
DB  920 DATA 153,34,173,34,59,58
    ,129,73
B4  930 DATA 178,49,164,55,56,58
    ,153,34
C8  940 DATA 192,34,59,58,130,73
    ,58,153
2B  950 DATA 34,189,34,59,0,211,
    30,150
E3  960 DATA 0,158,51,48,56,52,4
    4,50
3D  970 DATA 52,58,254,9,66,58,1
    58,51
27  980 DATA 48,55,50,44,50,52,4
    4,66
A1  990 DATA 176,49,50,56,58,32,
    32,32
44  1000 DATA 32,32,32,32,32,32,
    32,32
A2  1010 DATA 32,32,32,32,32,32,
    32,32
70  1020 DATA 32,32,32,143,32,32
    ,67,79
DE  1030 DATA 80,89,32,66,73,84,
    32,79
29  1040 DATA 78,0,24,31,160,0,1
    58,51
89  1050 DATA 48,55,50,44,51,50,
    44,48
C7  1060 DATA 58,158,51,48,55,50
    ,44,51
78  1070 DATA 51,44,48,58,158,51
    ,49,49
D9  1080 DATA 52,44,50,48,56,44,
    55,58
5A  1090 DATA 158,51,48,55,50,44
    ,51,48
E6  1100 DATA 44,50,52,48,58,32,
    32,143
04  1110 DATA 32,32,67,79,80,89,
    32,51
FF  1120 DATA 32,76,73,78,69,83,
    0,90
F0  1130 DATA 31,170,0,158,51,48
    ,55,50
31  1140 DATA 44,51,50,44,49,54,
    58,158
54  1150 DATA 51,48,55,50,44,51,
    51,44
1D  1160 DATA 48,58,158,51,49,49
    ,52,44
ED  1170 DATA 50,48,56,44,50,51,
    58,158
04  1180 DATA 51,48,55,50,44,51,
    48,44
0C  1190 DATA 50,52,48,58,143,32
    ,32,84
D8  1200 DATA 79,32,66,79,84,84,
    79,77
4C  1210 DATA 0,156,31,180,0,232
    ,58,158
07  1220 DATA 51,48,55,50,44,50,
    53,44
F2  1230 DATA 65,176,54,52,58,32
    ,32,32
53  1240 DATA 32,32,32,32,32,32,
    32,32
99  1250 DATA 32,32,32,32,32,32,
    32,32
E7  1260 DATA 32,32,32,32,32,32,
    32,32
1E  1270 DATA 32,32,32,32,32,32,
    143,32
83  1280 DATA 32,83,67,82,69,69,
    78,32
F3  1290 DATA 79,78,0,231,31,190
    ,0,158
8B  1300 DATA 51,48,55,50,44,50,
    52,44
31  1310 DATA 66,58,32,32,32,32,
    32,32
DA  1320 DATA 32,32,32,32,32,32,
    32,32
D0  1330 DATA 32,32,32,32,32,32,
    32,32
EE  1340 DATA 32,32,32,32,32,32,
    32,32
24  1350 DATA 32,32,32,32,32,32,
    32,32
6F  1360 DATA 32,32,32,32,32,32,
    143,32
9A  1370 DATA 32,67,79,80,89,32,
    66,73
8D  1380 DATA 84,32,79,70,70,0,2
    37,31
C3  1390 DATA 200,0,143,0,16,32,
    210,0
0F  1400 DATA 143,32,45,45,45,32
    ,80,82
21  1410 DATA 73,78,84,32,67,72,
    65,82
4E  1420 DATA 65,67,84,69,82,32,
    83,69
91  1430 DATA 84,83,32,45,45,45,
    0,22
7A  1440 DATA 32,220,0,143,0,34,
    32,230
BF  1450 DATA 0,76,73,78,69,178,
    171,49
17  1460 DATA 0,71,32,240,0,129,
    73,178
6B  1470 DATA 48,164,51,58,76,73
    ,78,69
15  1480 DATA 178,76,73,78,69,17
    0,49,58
A5  1490 DATA 153,34,153,76,73,7
    8,69,34
00  1500 DATA 59,76,73,78,69,0,1
    12,32
77  1510 DATA 250,0,80,83,178,56
    ,48,172
95  1520 DATA 73,170,49,54,58,72
    ,49,178
9E  1530 DATA 181,40,80,83,173,5
    0,53,54
93  1540 DATA 41,58,76,49,178,80
    ,83,171
DC  1550 DATA 50,53,54,172,72,49
    ,0,182
5C  1560 DATA 32,4,1,158,51,49,4
    9,52
A4  1570 DATA 44,76,49,44,72,49,
    170,49
02  1580 DATA 54,58,158,51,48,55
    ,50,44
69  1590 DATA 51,49,44,76,73,78,
    69,170
6A  1600 DATA 50,58,158,51,48,55
    ,50,44
FF  1610 DATA 51,48,44,54,51,58,
    32,32
7E  1620 DATA 32,32,32,32,32,32,
    143,32
F6  1630 DATA 32,67,79,76,79,82,
    32,83
70  1640 DATA 69,84,32,49,0,222,
```

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    32,14
37  1650 DATA 1,80,83,178,80,83,
    170,52
F4  1660 DATA 48,48,58,72,50,178
    ,181,40
E1  1670 DATA 80,83,173,50,53,54
    ,41,58
9E  1680 DATA 76,50,178,80,83,17
    1,50,53
FD  1690 DATA 54,172,72,50,0,36,
    33,24
02  1700 DATA 1,158,51,49,49,52,
    44,76
63  1710 DATA 50,44,72,50,170,49
    ,54,58
63  1720 DATA 158,51,48,55,50,44
    ,51,49
7F  1730 DATA 44,76,73,78,69,170
    ,49,51
1E  1740 DATA 50,58,158,51,48,55
    ,50,44
3B  1750 DATA 51,48,44,54,51,58,
    32,32
E4  1760 DATA 32,32,32,32,143,32
    ,32,67
5D  1770 DATA 79,76,79,82,32,83,
    69,84
C8  1780 DATA 32,50,0,87,33,34,1
    ,129
55  1790 DATA 74,178,48,164,54,5
    1,58,80
6D  1800 DATA 83,178,56,48,172,7
    3,170,74
CE  1810 DATA 170,49,54,58,72,66
    ,178,181
EF  1820 DATA 40,80,83,173,50,53
    ,54,41
EF  1830 DATA 58,76,66,178,80,83
    ,171,50
74  1840 DATA 53,54,172,72,66,0,
    161,33
22  1850 DATA 44,1,158,51,48,57,
    54,44
3A  1860 DATA 76,66,44,72,66,44,
    54,52
06  1870 DATA 172,73,170,74,58,1
    30,74,58
18  1880 DATA 32,32,32,32,32,32,
    32,32
16  1890 DATA 32,32,32,32,32,32,
    32,32
2C  1900 DATA 32,32,32,32,32,32,
    32,32
47  1910 DATA 32,32,32,32,32,32,
    143,32
F1  1920 DATA 32,54,52,32,67,72,
    65,82
7B  1930 DATA 83,44,32,83,69,84,
    49,0
6C  1940 DATA 230,33,54,1,158,51
    ,48,56
0E  1950 DATA 52,44,50,52,58,254
    ,9,66
CF  1960 DATA 58,158,51,48,55,50
    ,44,50
CB  1970 DATA 52,44,66,176,49,50
    ,56,58
7C  1980 DATA 32,32,32,32,32,32,
    32,32
7A  1990 DATA 32,32,32,32,32,32,
    32,32
25  2000 DATA 32,32,32,32,32,32,
    143,32
00  2010 DATA 32,67,79,80,89,32,
    66,73
6A  2020 DATA 84,32,79,78,0,47,3
    4,64
0F  2030 DATA 1,158,51,49,49,52,
    44,76
B0  2040 DATA 50,44,72,50,58,158
    ,51,48
34  2050 DATA 55,50,44,51,51,44,
    76,49
AB  2060 DATA 58,158,51,48,55,50
    ,44,51
AC  2070 DATA 50,44,72,49,58,32,
    32,32
DF  2080 DATA 32,32,32,32,32,32,
    32,32
B0  2090 DATA 32,32,32,32,143,32
    ,32,67
05  2100 DATA 79,80,89,32,70,79,
    82,32
F5  2110 DATA 83,69,84,32,50,0,1
    17,34
6A  2120 DATA 74,1,158,51,48,55,
    50,44
2E  2130 DATA 51,48,44,54,52,58,
    158,51
24  2140 DATA 48,55,50,44,50,52,
    44,66
57  2150 DATA 58,130,73,58,32,32
    ,32,32
2F  2160 DATA 32,32,32,32,32,32,
    32,32
35  2170 DATA 32,32,32,32,32,32,
    32,32
D6  2180 DATA 32,32,32,32,143,32
    ,32,67
94  2190 DATA 79,80,89,32,66,73,
    84,32
39  2200 DATA 79,70,70,0,123,34,
    84,1
57  2210 DATA 143,0,163,34,94,1,
    143,32
10  2220 DATA 45,45,45,32,80,82,
    73,78
B5  2230 DATA 84,32,82,69,77,65,
    73,78
24  2240 DATA 68,69,82,32,79,70,
    32,83
8C  2250 DATA 67,82,69,69,78,32,
    45,45
09  2260 DATA 45,0,169,34,104,1,
    143,0
D5  2270 DATA 213,34,114,1,224,4
    4,48,44
DC  2280 DATA 52,58,129,73,178,5
    2,164,50
49  2290 DATA 51,58,153,34,153,7
    6,73,78
0D  2300 DATA 69,34,59,73,58,130
    ,73,58
C7  2310 DATA 153,34,76,73,78,69
    ,32,50
3C  2320 DATA 52,145,34,0,2,35,1
    24,1
D5  2330 DATA 224,44,49,54,44,49
    ,49,58
70  2340 DATA 153,199,40,49,52,4
    1,59,34
3C  2350 DATA 205,79,86,69,32,65
    ,82,79
94  2360 DATA 85,78,68,32,70,82,
    69,69
15  2370 DATA 76,89,32,84,79,32,
    34,59
CB  2380 DATA 0,52,35,134,1,153,
    34,83
EB  2390 DATA 69,69,32,32,84,72,
    69,32
2E  2400 DATA 69,70,70,69,67,84,
    32,79
58  2410 DATA 70,32,84,72,69,32,
    83,80
7C  2420 DATA 82,73,84,69,32,77,
    79,86
EB  2430 DATA 73,78,71,32,79,86,
    69,82
26  2440 DATA 34,59,0,102,35,144
    ,1,224
60  2450 DATA 44,49,54,44,49,50,
    58,153
F9  2460 DATA 34,84,72,69,32,86,
    65,82
B0  2470 DATA 73,79,85,83,32,67,
    72,65
6A  2480 DATA 82,65,67,84,69,82,
    83,46
6F  2490 DATA 32,195,76,73,67,75
    ,73,78
25  2500 DATA 71,32,34,59,0,140,
    35,154
1F  2510 DATA 1,153,34,40,32,69,
    73,84
62  2520 DATA 72,69,82,32,66,85,
    84,84
66  2530 DATA 79,78,32,41,32,73,
    83,32
AF  2540 DATA 69,70,70,69,67,84,
    73,86
2B  2550 DATA 69,34,0,191,35,164
    ,1,224
10  2560 DATA 44,49,54,44,49,51,
    58,153
2B  2570 DATA 34,79,78,76,89,32,
    79,78
F2  2580 DATA 32,84,72,69,32,70,
    73,86
A3  2590 DATA 69,32,40,82,69,86,
    69,82
43  2600 DATA 83,69,68,41,32,65,
    82,69
EA  2610 DATA 65,83,32,34,59,0,2
    29,35
17  2620 DATA 174,1,153,34,83,72
    ,79,87
7F  2630 DATA 78,32,66,69,76,79,
    87,32
CF  2640 DATA 33,34,58,224,44,49
    ,54,44
4E  2650 DATA 49,54,58,153,199,4
    0,49,52
86  2660 DATA 50,41,59,0,17,36,1
    84,1
96  2670 DATA 153,34,154,18,32,6
    6,76,73
C9  2680 DATA 78,75,32,83,76,79,
    87,69
79  2690 DATA 82,32,34,163,51,57
    ,41,34
E6  2700 DATA 32,66,76,73,78,75,
    32,70
4E  2710 DATA 65,83,84,69,82,32,
    34,0
76  2720 DATA 70,36,194,1,224,44
    ,49,54
C3  2730 DATA 44,49,57,58,153,34
    ,155,18
FA  2740 DATA 32,32,77,79,78,79,
    67,72
CD  2750 DATA 82,79,77,69,32,32,
    34,163
90  2760 DATA 51,57,41,34,158,32
    ,32,32
6A  2770 DATA 32,67,79,76,79,82,
    32,32
7B  2780 DATA 32,32,32,34,0,102,
    36,204
A8  2790 DATA 1,224,44,49,54,44,
    50,50
D8  2800 DATA 58,153,34,154,18,3
    2,32,32
E5  2810 DATA 32,32,81,85,73,84,
    32,32
53  2820 DATA 32,32,32,34,0,142,
    36,214
50  2830 DATA 1,224,44,54,50,44,
    49,53
B2  2840 DATA 58,153,34,153,213,
    34,59,58
06  2850 DATA 129,73,178,48,164,
    49,52,58
FD  2860 DATA 153,34,192,34,59,5
    8,130,58
11  2870 DATA 153,34,201,34,0,17
    6,36,224
6F  2880 DATA 1,129,73,178,49,54
    ,164,50
0F  2890 DATA 51,58,224,44,54,50
    ,44,73
52  2900 DATA 58,153,34,194,34,1
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66,49,53
6D 2910 DATA 41,34,194,34,58,13
0,0,216
79 2920 DATA 36,234,1,224,44,54
,50,44
08 2930 DATA 50,52,58,153,34,20
2,34,59
DA 2940 DATA 58,129,73,178,48,1
64,49,52
9B 2950 DATA 58,153,34,192,34,5
9,58,130
35 2960 DATA 58,153,34,203,145,
34,0,248
0B 2970 DATA 36,244,1,224,44,54
,53,44
09 2980 DATA 49,54,58,153,199,4
0,49,52
7E 2990 DATA 41,34,28,211,80,69
,69,68
CB 3000 DATA 58,32,32,32,48,34,
0,19
65 3010 DATA 37,254,1,224,44,54
,53,44
CC 3020 DATA 50,48,58,153,34,19
5,204,201
31 3030 DATA 195,203,197,196,32
,193,212,58
A6 3040 DATA 34,0,49,37,8,2,224
,44
7A 3050 DATA 54,51,44,50,50,58,
153,34
5A 3060 DATA 216,44,217,32,32,6
1,32,32
1C 3070 DATA 32,45,44,32,32,45,
34,0
D5 3080 DATA 112,37,18,2,224,44
,54,51
4E 3090 DATA 44,50,51,58,153,34
,208,201
15 3100 DATA 216,32,32,61,32,32
,32,45
24 3110 DATA 44,32,32,45,34,58,
151,50
C6 3120 DATA 53,54,52,44,194,40
,50,53
C7 3130 DATA 54,52,41,176,49,58
,32,143
9C 3140 DATA 32,32,66,65,83,46,
32,73
40 3150 DATA 78,84,46,32,79,78,
0,118
60 3160 DATA 37,28,2,143,0,132,
37,38
63 3170 DATA 2,143,32,45,45,45,
32,45
6F 3180 DATA 45,45,0,138,37,48,
2,143
4F 3190 DATA 0,205,37,58,2,67,7
9,76
65 3200 DATA 178,48,58,83,80,69
,69,68
C4 3210 DATA 178,48,58,88,69,17
8,52,53
AD 3220 DATA 58,89,69,178,50,50
,58,88
01 3230 DATA 80,178,48,58,89,80
,178,48
9B 3240 DATA 58,254,2,48,58,32,
32,32
B1 3250 DATA 32,32,32,32,32,32,
32,32
CD 3260 DATA 32,32,32,32,143,32
,32,73
56 3270 DATA 78,73,84,0,211,37,
68,2
3C 3280 DATA 143,0,225,37,78,2,
143,32
78 3290 DATA 45,45,45,32,45,45,
45,0
D9 3300 DATA 231,37,88,2,143,0,
38,38
C6 3310 DATA 98,2,153,34,158,34
,59,58
BE 3320 DATA 158,53,55,51,52,52
,44,49
13 3330 DATA 50,56,172,67,79,76
,170,83
A5 3340 DATA 80,69,69,68,44,88,
69,44
FC 3350 DATA 89,69,58,32,32,32,
32,32
DA 3360 DATA 32,32,32,32,32,32,
32,32
77 3370 DATA 32,32,32,32,32,143
,32,32
A3 3380 DATA 76,79,79,80,0,79,3
8,108
12 3390 DATA 2,254,9,65,44,88,6
7,44
F7 3400 DATA 89,67,58,224,44,55
,48,44
0E 3410 DATA 50,50,44,34,28,32,
32,32
88 3420 DATA 34,58,224,44,54,57
,44,50
29 3430 DATA 50,58,153,88,67,0,
109,38
07 3440 DATA 118,2,224,44,55,53
,44,50
21 3450 DATA 50,44,34,32,32,32,
34,58
F1 3460 DATA 224,44,55,53,44,50
,50,58
C7 3470 DATA 153,89,67,0,161,38
,128,2
AA 3480 DATA 158,53,55,52,48,50
,58,254
77 3490 DATA 9,65,44,88,58,88,8
0,178
82 3500 DATA 50,53,54,172,88,17
0,65,58
C0 3510 DATA 158,53,55,52,50,55
,58,254
70 3520 DATA 9,65,44,88,58,89,8
0,178
9B 3530 DATA 50,53,54,172,88,17
0,65,0
BE 3540 DATA 225,38,138,2,224,4
4,55,48
93 3550 DATA 44,50,51,44,34,32,
32,32
9C 3560 DATA 34,58,224,44,54,57
,44,50
B7 3570 DATA 51,58,153,88,80,58
,32,32
B6 3580 DATA 32,32,32,32,32,32,
32,32
CB 3590 DATA 32,32,32,32,32,32,
32,32
46 3600 DATA 32,32,32,143,32,32
,80,82
86 3610 DATA 73,78,84,32,80,79,
83,0
2B 3620 DATA 12,39,148,2,224,44
,55,53
98 3630 DATA 44,50,51,44,34,32,
32,32
D3 3640 DATA 34,58,224,44,55,52
,44,50
96 3650 DATA 51,58,153,89,80,58
,88,69
D3 3660 DATA 178,50,53,53,58,89
,69,178
DB 3670 DATA 88,69,0,39,39,158,
2,139
95 3680 DATA 89,67,179,49,54,13
7,54,49
5B 3690 DATA 48,58,213,139,89,6
7,177,49
0E 3700 DATA 54,137,55,52,48,0,
66,39
A1 3710 DATA 168,2,139,88,67,17
9,49,54
38 3720 DATA 137,54,49,48,58,21
3,139,88
7D 3730 DATA 67,177,50,57,137,5
5,48,48
C7 3740 DATA 0,125,39,178,2,139
,83,80
7E 3750 DATA 69,69,68,177,48,17
5,83,80
37 3760 DATA 69,69,68,179,49,54
,167,83
C5 3770 DATA 80,69,69,68,178,83
,80,69
74 3780 DATA 69,68,170,49,58,13
7,55,50
E9 3790 DATA 48,58,213,55,50,48
,58,32
B9 3800 DATA 32,32,143,32,32,83
,76,79
7F 3810 DATA 87,69,82,0,146,39,
188,2
6A 3820 DATA 139,88,67,179,51,5
7,176,88
53 3830 DATA 67,177,53,50,137,5
4,49,48
5A 3840 DATA 0,206,39,198,2,139
,83,80
49 3850 DATA 69,69,68,178,48,16
7,83,80
E8 3860 DATA 69,69,68,178,49,53
,58,213
C4 3870 DATA 139,83,80,69,69,68
,177,49
08 3880 DATA 167,83,80,69,69,68
,178,83
80 3890 DATA 80,69,69,68,171,49
,58,32
97 3900 DATA 32,32,32,143,32,32
,70,65
94 3910 DATA 83,84,69,82,0,228,
39,208
F2 3920 DATA 2,139,83,80,69,69,
68,178
17 3930 DATA 49,54,167,83,80,69
,69,68
0E 3940 DATA 178,48,0,9,40,218,
2,224
6D 3950 DATA 44,55,51,44,49,54,
44,34
03 3960 DATA 32,32,34,58,224,44
,55,50
CE 3970 DATA 44,49,54,58,153,83
,80,69
57 3980 DATA 69,68,58,137,54,49
,48,0
77 3990 DATA 36,40,228,2,139,89
,67,179
1B 4000 DATA 49,57,137,54,49,48
,58,213
AE 4010 DATA 139,89,67,177,49,5
7,137,55
19 4020 DATA 57,48,0,63,40,238,
2,139
35 4030 DATA 88,67,179,49,54,13
7,54,49
2D 4040 DATA 48,58,213,139,88,6
7,177,50
FE 4050 DATA 57,137,55,55,48,0,
135,40
AE 4060 DATA 248,2,67,79,76,178
,49,58
F5 4070 DATA 137,54,49,48,58,32
,32,32
B8 4080 DATA 32,32,32,32,32,32,
32,32
B6 4090 DATA 32,32,32,32,32,32,
32,32
CB 4100 DATA 32,32,32,32,32,32,
32,32
11 4110 DATA 32,32,32,32,32,32,
32,32
DF 4120 DATA 32,32,32,32,32,32,
32,32
97 4130 DATA 143,32,32,77,79,78
,79,67
53 4140 DATA 72,82,79,77,69,0,1
56,40
A9 4150 DATA 2,3,139,88,67,179,
51,57
FE 4160 DATA 176,88,67,177,50,5
```

```
    0,137,54
34  4170 DATA 49,48,0,223,40,12,
    3,67
F6  4180 DATA 79,76,178,48,58,13
    7,54,49
20  4190 DATA 48,58,32,32,32,32,
    32,32
2F  4200 DATA 32,32,32,32,32,32,
    32,32
35  4210 DATA 32,32,32,32,32,32,
    32,32
83  4220 DATA 32,32,32,32,32,32,
    32,32
49  4230 DATA 32,32,32,32,32,32,
    32,32
C2  4240 DATA 32,32,32,32,32,143
    ,32,32
89  4250 DATA 67,79,76,79,82,0,2
    51,40
EC  4260 DATA 22,3,139,89,67,179
    ,177,50
3E  4270 DATA 50,176,88,67,179,4
    9,54,176
AD  4280 DATA 88,67,177,50,57,13
    7,54,49
CC  4290 DATA 48,0,50,41,32,3,25
    4,2
78  4300 DATA 49,53,58,158,51,48
    ,55,50
F6  4310 DATA 44,54,44,50,53,58,
    158,51
80  4320 DATA 48,55,50,44,50,48,
    44,56
90  4330 DATA 58,151,50,54,48,55
    ,44,56
C7  4340 DATA 58,232,58,32,32,32
    ,32,32
B2  4350 DATA 32,143,32,32,81,85
    ,73,84
7A  4360 DATA 0,75,41,42,3,153,1
    99,40
24  4370 DATA 49,52,50,41,34,158
    ,84,72
BB  4380 DATA 65,78,75,83,17,17,
    34,58
E3  4390 DATA 128,0,0,0
```

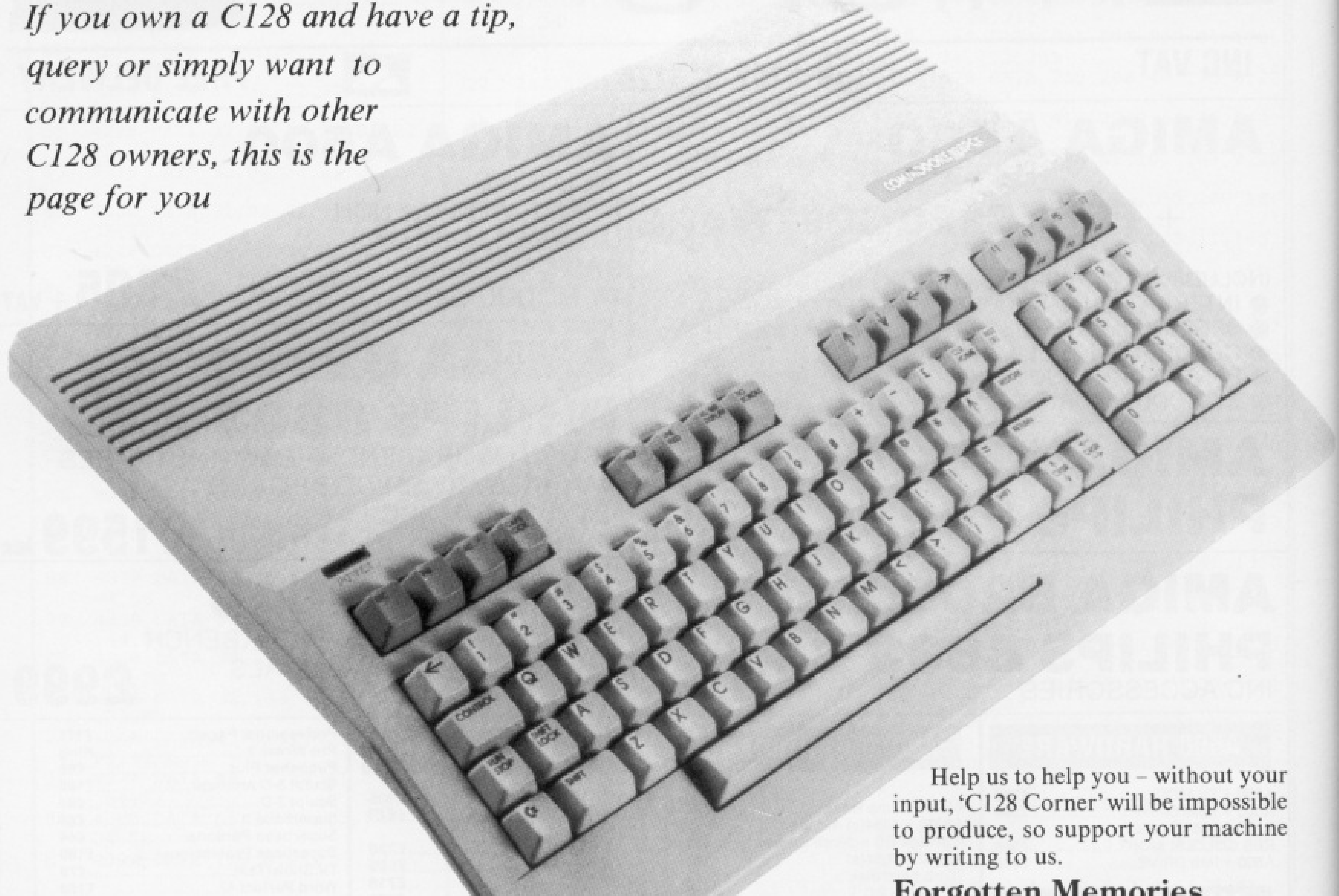
PROGRAM:ENTER64/INTER

```
EF  10 IFPEEK(43)=81ANDPEEK(44)=
    41GOTO30
41  20 PRINT"YOU DID NOT ENTER T
    HE POKES CORRECTLY !":END
DC  30 M=1:T=0
D0  40 FORI=7169TO9903:PRINT"[UP
    ]POKING AT:"I:READA:T=T+A*M
B4  50 M=M+1:IFM>10THENM=1
5E  60 IFT>32000THENT=T-32000
CF  70 POKEI,A:NEXT
69  80 IFT=11046GOTO100
36  90 PRINT"ERROR: CHECK DATA S
    TATEMENTS !":END
4D  100 PRINT"SAVING INTER128":P
    OKE43,1:POKE44,28:POKE45,177
    :POKE46,38
C6  110 SAVE"INTER128",8,1
D1  120 POKE44,8:NEW:END
63  130 DATA 11,28,10,0,79,85,84
    ,178
48  140 DATA 56,0,64,28,20,0,153
    ,34
F3  150 DATA 80,79,75,73,78,71,3
    2,46
7F  160 DATA 46,46,34,58,254,2,4
    8,58
14  170 DATA 129,73,178,48,164,5
    0,53,50
82  180 DATA 56,58,151,53,55,51,
    52,52
7B  190 DATA 170,73,44,194,40,55
    ,51,55
3C  200 DATA 54,170,73,41,58,130
    ,0,82
50  210 DATA 28,30,0,153,34,83,6
    5,86
3C  220 DATA 73,78,71,32,46,46,4
    6,34
37  230 DATA 0,138,28,40,0,254,2
    ,49
22  240 DATA 53,58,158,54,53,52,
    54,54
6B  250 DATA 44,49,44,79,85,84,4
    4,48
7A  260 DATA 58,158,54,53,52,54,
    57,44
50  270 DATA 56,44,49,56,56,44,5
    0,56
D0  280 DATA 58,151,49,57,56,44,
    48,48
5B  290 DATA 58,151,49,57,57,44,
    48,48
90  300 DATA 0,186,28,50,0,151,5
    0,53
E6  310 DATA 48,44,48,58,151,50,
    53,49
37  320 DATA 44,50,50,52,58,158,
    54,53
57  330 DATA 52,57,54,44,50,53,4
    8,44
5D  340 DATA 50,50,52,44,50,51,5
    1,58
31  350 DATA 153,34,17,79,75,34,
    58,128
FB  360 DATA 0,0,0,67,72,69,69,8
    3
0A  370 DATA 69,56,48,0,0,0,0,0
0B  380 DATA 0,0,0,0,0,0,0,76
AF  390 DATA 98,224,141,0,214,44
    ,0,214
8B  400 DATA 16,251,142,1,214,96
    ,141,0
63  410 DATA 214,44,0,214,16,251
    ,173,1
4C  420 DATA 214,96,32,45,224,15
    2,170,169
6C  430 DATA 31,76,3,224,32,45,2
    24,169
8C  440 DATA 31,76,15,224,72,169
    ,18,32
20  450 DATA 3,224,104,170,169,1
    9,76,3
12  460 DATA 224,173,104,234,141
    ,92,234,173
45  470 DATA 105,234,141,93,234,
    14,92,234
F4  480 DATA 46,93,234,173,92,23
    4,174,93
7A  490 DATA 234,96,173,109,234,
    141,92,234
D1  500 DATA 173,110,234,141,93,
    234,76,76
BA  510 DATA 224,120,216,141,8,2
    34,41,15
4B  520 DATA 141,11,234,169,1,14
    1,92,234
5B  530 DATA 224,255,240,26,142,
    9,234,142
5C  540 DATA 104,234,169,0,141,1
    05,234,141
D9  550 DATA 92,234,14,104,234,4
    6,105,234
35  560 DATA 14,104,234,46,105,2
    34,192,255
13  570 DATA 240,32,140,10,234,1
    40,109,234
36  580 DATA 169,0,141,110,234,1
    41,92,234
9F  590 DATA 14,109,234,46,110,2
    34,14,109
21  600 DATA 234,46,110,234,14,1
    09,234,46
78  610 DATA 110,234,173,92,234,
    208,5,169
F7  620 DATA 192,141,76,234,173,
    0,255,72
83  630 DATA 160,3,162,0,181,250
    ,72,232
D5  640 DATA 136,16,249,169,62,1
    41,0,255
58  650 DATA 169,0,141,14,234,17
    3,25,212
99  660 DATA 201,255,208,51,173,
    26,212,201
8C  670 DATA 255,208,44,173,0,22
    0,16,7
39  680 DATA 41,127,9,64,76,244,
    224,9
88  690 DATA 128,41,191,141,0,22
    0,173,25
14  700 DATA 212,201,255,208,18,
    173,26,212
7E  710 DATA 201,255,208,11,169,
    1,141,14
E9  720 DATA 234,141,16,234,141,
    15,234,169
D6  730 DATA 28,32,15,224,41,224
    ,141,7
8F  740 DATA 234,169,0,141,6,234
    ,169,20
91  750 DATA 32,15,224,141,5,234
    ,169,21
94  760 DATA 32,15,224,141,4,234
    ,169,12
D4  770 DATA 32,15,224,141,24,23
    4,169,13
3D  780 DATA 32,15,224,141,23,23
    4,169,0
2F  790 DATA 141,73,234,141,13,2
    34,173,11
36  800 DATA 234,141,12,234,173,
    25,212,141
DD  810 DATA 20,234,173,26,212,1
    41,21,234
C2  820 DATA 169,6,32,15,224,141
    ,22,234
71  830 DATA 169,26,32,15,224,72
    ,41,15
7C  840 DATA 141,92,234,165,241,
    10,10,10
3C  850 DATA 10,13,92,234,170,16
    9,26,32
26  860 DATA 3,224,169,25,32,15,
    224,72
88  870 DATA 174,8,234,16,8,41,1
    91,170
45  880 DATA 169,25,32,3,224,32,
    69,226
A1  890 DATA 173,19,234,240,14,1
    69,0,141
8F  900 DATA 13,234,173,11,234,1
    41,12,234
3B  910 DATA 76,185,225,173,11,2
    34,240,16
FC  920 DATA 206,12,234,208,11,1
    73,13,234
4A  930 DATA 73,255,141,13,234,7
    6,155,225
78  940 DATA 32,33,228,32,51,229
    ,32,244
AB  950 DATA 232,169,0,141,100,2
    34,32,9
5D  960 DATA 231,32,7,226,201,0,
    240,189
DE  970 DATA 170,202,142,19,234,
    141,100,234
04  980 DATA 32,9,231,88,104,170
    ,169,25
EE  990 DATA 32,3,224,104,170,16
    9,26,32
BF  1000 DATA 3,224,162,3,104,14
    9,250,202
BB  1010 DATA 16,250,104,141,0,2
    55,169,0
0D  1020 DATA 133,208,133,209,17
    3,19,234,174
A6  1030 DATA 9,234,172,10,234,9
    6,173,14
1A  1040 DATA 234,208,37,173,1,2
    20,41,1
3A  1050 DATA 240,27,173,1,220,4
```

Continued next issue

C128 Corner

If you own a C128 and have a tip, query or simply want to communicate with other C128 owners, this is the page for you



The Commodore 128 computer is a bit of a white elephant. Its memory and capabilities really do put some other computers, including the C64 and C16, to shame. Not only does it offer total compatibility with the extremely popular C64, but it also boasts an impressive Basic, both 40 and 80 column screen formats and a massive 128K memory (not as much as an Amiga, but double that of a C64).

Not only do the facilities of the machine itself far surpass those of the C64, but its disk drives are superior to the lumbering 1541's. Both the 1570 and 1571 are far quicker than the 1541 drive, but the 1571 is also double-sided, giving double the amount of storage per disk – without having to resort to the flippy technique of turning the disk over.

Unfortunately though, the similarities between the C128 and the white elephant do not end with the size and power of the computer – software for the C128 is extremely scarce and the C128 computer itself seems to be about as common as a white elephant.

It's a great shame that the C128 was never given the acclaim it deserved by the software houses, or even Commodore itself. *Your Commodore* has been one of the few magazines that has continually supported the C128 range over the years, and this page is simply an extension of that support.

'C128 Corner' is the page for all Commodore 128 users. It's designed to be a forum for all queries and tips relating to your computer. But, and it's a big but, '128 Corner' cannot succeed without your help. If you have a query about your 128 or software for the machine, then write to this page. If you have a tip you'd like to share with other C128 users, write to us. If you learn about anything happening in the C128 world that hasn't been covered in the magazine, write to us.

Help us to help you – without your input, 'C128 Corner' will be impossible to produce, so support your machine by writing to us.

Forgotten Memories

The *Your Commodore* office often receives queries about software that works on "a friend's C128D" but not on their C128. This is usually due to the fact that the C128 and C128D computers are not totally identical – the C128D computer has more video memory than most (but not all) standard C128 computers. This difference only becomes apparent if you're running a program that uses the extra 64K of video RAM that is present on some 128s.

The problem is not insurmountable. All that's required is a memory upgrade for your C128 that gives your computer access to 64K extra video RAM. Financial Systems Software is the only company we're aware of that sells such a memory upgrade. It's a small circuit board that's plugged into the board inside your C128.

As long as you can use a screwdriver and are capable of delicate work, you should have no problems fitting the board yourself. Don't forget though, that if you do open up your

C128 you'll invalidate your guarantee. Once the board is fitted, programs that require aditional video RAM will work with no problems.

Financial Systems Software, suppliers of the aforementioned RAM board, is probably the biggest supplier of C128 software at the moment. If you do own a C128, then I suggest you take a look at FSSs ads, or even get hold of their catalogue, since they offer an impressive range of products – including an excellent C128 newsletter/magazine.

FSS can be contacted at:
18 High Street,
Pershore, Worcs
WR10 1BG
Tel: (0386) 553153

Write All About It

Since the C128 has an 80-column screen, it's ideal for use as a wordprocessor – in fact much of *Your Commodore* is written using C128s – both the Editor and Technical Editor use them for all their wordprocessing.

We receive a large number of telephone calls and letters asking just what wordprocessors are available for the C128 range. To our knowledge there are at least four wordprocessing packages available. Firstly there is Superscript 128. This offers both 40 and 80-column display options, and is fully compatible with the popular C64 version of the same program. This is available from Precision Software (Tel: 01-330 7166), at £29.95.

Viza Classic from Viza Software offered the user a full 'What You See Is What You Get' (WYSIWYG) display, together with easy-to-use pull down menus. Viza Classic only works in 80-columns. Viza Classic no longer seems to be available, but, if you scour the computer shows you should find it.

American software publishers Batteries Not Included have produced a number of versions of their Paperclip wordprocessor for the C128. The favourite in the office is Paperclip II. This version not only has superb wordprocessing facilities, but also has an inbuilt communications package. Batteries Not Included do not market in the UK, but you could try contacting them directly at in the States.

The final wordprocessor we've looked at is Font Master 128. This wordprocessor not only offers the normal editing features you'd expect, but also allows you to print out your text in a variety of fonts – you can even design your own fonts if you're feeling particularly creative.

Should you only have a dot matrix printer, then you may find that this is an excellent choice for you, as the quality of the printout will probably be better than the normal quality that you get from your print mechanism.

Fontmaster 128 is available from FSSL.

Please Write In

We cannot stress too much that if you own a C128 then this is your section of the magazine, and that we need to hear from you in order to produce this page for you. Should you have any hints, tips, questions, news or comments, then please write to:

C128 Corner,
Your Commodore,
Argus House,
Boundary Way,
Hemel Hempstead,
Herts HP2 1ST.

Quick Search



If you need to change anything in your Basic text, find and list it with this handy routine

By Neil Higgins

How many times have you been programming in Basic, and suddenly found out that you need to change a variable to another value, or re-edit a string of text? Put it this way – if you'd a pound for every time you've had to re-edit a Basic program, you'd be richer than the editor of *Your Commodore!*

The main problem encountered is that you always need to search the whole program to make sure all the correct changes have been made, especially if it's a variable that needs changing.

This all adds up to lots of typing of the command LIST, which in a long program can be a bit of a pain. Well fear no more, the routine given here will do all the searching and listing for you, and all you need supply is the text to be searched for. To do this, the syntax is:

SYS49152, Text

For example, if you wanted to list all the lines in your program where the variable A$ appears, you would simply enter:-

SYS49152,A$

Keywords can also be searched for. If you wanted to list all REM statements, you'd enter:-

SYS49152, REM

As with all keywords, to save a bit of typing you can enter the abbreviated form. For example, to search for all occurrences of the PRINT statement you may use:-

SYS49152,?

If you wanted to search for a full string, that's how you would enter it. For example, to find a string defined as "My word", you'd enter:-

SYS49152, "My word".

Note that the same string would also be listed if you entered:-

SYS49152, My word.

But so would any other lines containing the words, My word, if you get my point?

If you experiment with a large Basic program, you'll find out the easiest ways to use the routine. Sometimes, if the chosen text appears in a lot of lines, they will disappear off the top of the screen like a normal listing. To prevent this, you can use the space bar to pause the listing, in which case pressing another key will continue the search. The Run/stop key will break out. Please note: this routine can only be called in direct mode, not from within a Basic program.

For the technically minded, the routine resides in the 4K block of Ram from $C000, and stores the text to be searched for in a table directly after itself. Machine coders will find the source code useful, particularly if they wish to conclude the routine as part of an extended Basic type program. The routine was written using the *Your Commodore* Speedy Assembler, but should be transportable to most assemblers.

Getting It All In

I've supplied two methods of typing in the program. Method one provides the source listing if you have an assembler. This listing is well documented, so you can see how the routine works. Secondly, I have provided a Basic loader. Remember to save your efforts before running it – accidents will happen.

```
PROGRAM:QUICK SEARCH

A1  100 REM *********************
    *********
18  110 REM *        QUICK SEARCH
    *
86  120 REM *--------------------
    ---------*
67  130 REM *  BY N.HIGGINS NOVE
    MBER 88 *
8A  140 REM *--------------------
    ---------*
E1  150 REM * SYS49152,TEXT (OR
    "TEXT") *
E5  160 REM *********************
    *********
25  170 REM
3B  180 REM
97  190 PRINTCHR$(147):POKE53281
    ,0:POKE646,7
5C  200 PRINT"[DOWN2,RIGHT]PLEAS
    E WAIT - POKEING IN MACHINE
    CODE"
58  210 GOSUB460:POKE53280,0
08  220 PRINT"[CLR,DOWN2,RIGHT2]
    QUICK SEARCH M/C NOW IN MEMO
    RY"
6C  230 PRINT"[DOWN2,RIGHT2]SELE
    CT OPTION (1-3)"
13  240 PRINT"[DOWN2,RIGHT2](1)
    SAVE CODE TO DISK"
CC  250 PRINT"[DOWN,RIGHT2](2) S
    AVE CODE TO TAPE"
FF  260 PRINT"[DOWN,RIGHT2](3) E
    XIT"
7F  270 GETA$:IFA$=""THEN270
E8  280 A=VAL(A$):IFA<1ORA>3THEN
    270
9C  290 IFA=3THEN410
FF  300 A$="PREPARE CASSETTE FOR
     SAVING":D=1
5E  310 IFA=1THENA$="PLACE REQUI
    RED DISK IN DRIVE":D=8
C0  320 PRINT"[CLR,RIGHT]";A$:PR
    INT"[DOWN3,RIGHT3]PRESS ANY
    KEY WHEN READY"
BE  330 POKE198,0:WAIT198,1:POKE
    198,0
5A  340 REM ------- SAVE MACHINE
    CODE -------
D3  350 SYS57812"Q.SEARCH M/C",D
    ,1:REM * FILENAME *
E7  360 POKE193,0:POKE194,192:RE
    M * START ADDRESS TO SAVE ($
```

```
    C000) *
33  370 POKE174,60:POKE175,193:R
    EM * END ADDRESS TO SAVE-1 (
    $C13B) *
F2  380 REM
C5  390 SYS62957:REM * PERFORM S
    AVE *
1E  400 REM
05  410 PRINT"[CLR,DOWN,RIGHT]OK
    AY - SYS49152,TEXT - TO SEAR
    CH BASIC"
25  420 END
20  430 REM
36  440 REM
4C  450 REM
15  460 FORL=0TO19:CX=0:FORD=0TO
    15:READA:CX=CX+A:POKE49152+L
    *16+D,A:NEXTD
F6  470 POKE53280,(PEEK(53280)AN
    D15)+1
DC  480 READA:IFA<>CXTHENPRINT"E
    RROR IN LINE";530+(L*10):STO
    P
B5  490 NEXTL
7B  500 RETURN
70  510 REM
85  520 REM
6E  530 DATA 162,95,169,0,157,58
    ,193,202,16,250,165,157,48,3
    ,76,8,1759
60  540 DATA 175,160,6,185,0,2,2
    01,44,208,244,162,4,200,185,
    0,2,1778
23  550 DATA 240,11,157,58,193,2
    32,200,192,89,208,242,240,22
    5,192,7,240,2726
40  560 DATA 221,32,215,170,162,
    58,169,193,134,251,133,252,1
    66,43,165,44,2408
46  570 DATA 160,1,134,253,133,2
    54,177,253,208,3,76,116,164,
    141,54,193,2320
CF  580 DATA 136,177,253,141,53,
    193,160,4,140,56,193,140,57,
    193,177,251,2324
64  590 DATA 201,34,208,3,238,57
    ,193,172,57,193,177,251,240,
    37,141,55,2257
40  600 DATA 193,172,56,193,177,
    253,240,19,173,55,193,209,25
    3,240,7,238,2671
F5  610 DATA 56,193,160,4,208,21
    3,238,56,193,208,217,174,53,
    193,173,54,2393
E5  620 DATA 193,208,173,160,2,1
    77,253,133,20,200,177,253,13
    3,21,32,164,2299
D4  630 DATA 192,76,139,192,32,1
    9,166,160,1,132,15,177,95,24
    0,87,234,1957
4E  640 DATA 234,234,32,228,255,
    240,17,201,3,240,143,201,32,
    208,9,32,2309
A6  650 DATA 228,255,240,251,201
    ,3,240,130,160,2,177,95,170,
    200,177,95,2624
F7  660 DATA 197,21,208,4,228,20
    ,240,2,176,44,132,73,32,205,
    189,169,1940
2F  670 DATA 32,164,73,41,127,32
    ,71,171,201,34,208,6,165,15,
    73,255,1668
ED  680 DATA 133,15,200,240,17,1
    77,95,208,16,168,177,95,170,
    200,177,95,2183
31  690 DATA 134,95,133,96,208,1
    61,76,215,170,234,16,217,201
    ,255,240,213,2664
98  700 DATA 36,15,48,209,56,233
    ,127,170,132,73,160,255,202,
    240,8,200,2164
62  710 DATA 185,158,160,16,250,
    48,245,200,185,158,160,48,18
    0,32,71,171,2267
2D  720 DATA 208,245,76,215,170,
    0,0,0,0,0,0,72,17,160,87,74,
    1324
READY.
```

```
10      ;*******************************
20      ;*     QUICK SEARCH SOURCE     *
30      ;*-----------------------------*
40      ;*         BY N.HIGGINS        *
50      ;*-----------------------------*
60      ;*   LISTS BASIC LINES THAT    *
70      ;*   CONTAIN THE GIVEN TEXT.   *
80      ;*-----------------------------*
90      ;* SYS49152,TEXT (OR "TEXT")   *
100     ;*  USES ($FB) AND ($FD)       *
110     ;*******************************
120     ;
130     ;
140                 ORG $C000
150     ;
160     INPBUFF     EQU $0200
170     PRGMODE     EQU $9D
180     RESTART     EQU $A474
190     SYNERR      EQU $AF08
200     CARRET      EQU $AAD7
210     FNDLIN      EQU $A613
220     GETIN       EQU $FFE4
230     FLAG        EQU $0F
240     FORPNT      EQU $49
250     LINPRT      EQU $BDCD
260     OUTDO       EQU $AB47
270     KEYWORD     EQU $A09E
280     ;
290     ;
300     ;CLEAR AREA AFTER MAIN PROGRAM
310     ;FOR TEXT TO BE SEARCHED FOR.
320     ;CHECK FOR DIRECT MODE($9D=#$80)
330     ;GET TEXT AFTER SYS49152, FROM
340     ;THE INPUT BUFFER AND STORE.
350     ;OUTPUT CARRIAGE RETURN,AND PUT
360     ;STORAGE START IN ($FB).
370     ;
380     ;
390     SEARCH      LDX #95
400                 LDA #0
410     LOOPY       STA STORAGE,X
420                 DEX
430                 BPL LOOPY
440     ;
450                 LDA PRGMODE
460                 BMI OKAY
470     ERROR       JMP SYNERR
480     ;
490     OKAY        LDY #6
500                 LDA INPBUFF,Y
510                 CMP ',
520                 BNE ERROR
530                 LDX #4
540                 INY
550     LOOP        LDA INPBUFF,Y
560                 BEQ DONE
570                 STA STORAGE,X
580                 INX
590                 INY
600                 CPY #$59
610                 BNE LOOP
620                 BEQ ERROR
630     DONE        CPY #7
640                 BEQ ERROR
650                 JSR CARRET
660     ;
670                 LDX #<STORAGE
680                 LDA #>STORAGE
690                 STX $FB
700                 STA $FC
710     ;
720     ;MAIN LOOP STARTS HERE.
730     ;GET BASIC START IN ($FD)
740     ;AND CHECK NEXT BYTE FOR END OF
750     ;PROGRAM.IF ZERO THEN FINISH
760     ;VIA $A474 (READY).
770     ;
780     ;
790                 LDX $2B
800                 LDA $2C
810     START       LDY #1
820                 STX $FD
830                 STA $FE
840                 LDA ($FD),Y
850                 BNE NEXT
860     FINISH      JMP RESTART
870     ;
880     ;SEARCH BASIC FOR CHOSEN TEXT
890     ;IN STORAGE AREA.
900     ;
910     ;
920     NEXT        STA LINKHI
930                 DEY
940                 LDA ($FD),Y
950                 STA LINKLO
960                 LDY #4
970                 STY COUNTLO
980     LOOP6       STY COUNTHI
990                 LDA ($FB),Y
1000                CMP '"
1010                BNE LOOP2
1020    LOOP7       INC COUNTHI
1030    LOOP2       LDY COUNTHI
1040                LDA ($FB),Y
1050                BEQ LOOP3
1060    DOIIT       STA MATCH
1070                LDY COUNTLO
1080                LDA ($FD),Y
```

```
                BEQ LOOP4
                LDA MATCH
                CMP ($FD),Y
                BEQ LOOP5
                INC COUNTLO
                LDY #4
                BNE LOOP6
;
LOOP5           INC COUNTLO
                BNE LOOP7
;
LOOP4           LDX LINKLO
                LDA LINKHI
                BNE START
;
;PUT LINE NO. BEING SEARCHED IN
;($14).AND JSR TO $A613 WHICH
;SEARCHES BASIC FOR LINE NO. IN
;($14) AND PUTS THE LINK ADDRESS
;IN ($5F).
;
;
LOOP3           LDY #2
                LDA ($FD),Y
                STA $14
                INY
                LDA ($FD),Y
                STA $15
                JSR LOOP10
                JMP LOOP4
;
LOOP10          JSR FNDLIN
;
;GET LINE LINK ADDRESS IF ZERO
;THEN PRINT CARRIAGE RETURN AND
;RTS.IF NOT THEN CHECK FOR PRESS
;OF SPACE-BAR OR RUN/STOP KEY
;AND TAKE APPROPRIATE ACTION.
;
LOOP11          LDY #1
                STY FLAG
                LDA ($5F),Y
                BEQ OUT
                NOP
                NOP
                NOP
                JSR GETIN
                BEQ CARRYON
                CMP #3
                BEQ FINISH
                CMP #32
                BNE CARRYON
GETKEY2         JSR GETIN
                BEQ GETKEY2
                CMP #3
                BEQ FINISH
;
;MAIN ROUTINE TO LIST A BASIC
;LINE STARTS HERE............
;COULD BE RE-WRITTEN BUT THIS
;WILL SUFFICE!
;GET LINE NO. AND PRINT TO
;SCREEN USING $BDCD.LIST TEXT
;USING $AB47.
;
;
CARRYON         LDY #2
                LDA ($5F),Y
                TAX
                INY
                LDA ($5F),Y
                CMP $15
                BNE LOOP12
                CPX $14
                BEQ LOOP13
LOOP12          BCS OUT
LOOP13          STY FORPNT
                JSR LINPRT
                LDA #$20
LOOP20          LDY FORPNT
                AND #$7F
LOOP16          JSR OUTDO
                CMP #$22
                BNE LOOP14
                LDA FLAG
                EOR #$FF
                STA FLAG
LOOP14          INY
                BEQ OUT
                LDA ($5F),Y
                BNE LOOP15
                TAY
                LDA ($5F),Y
                TAX
                INY
                LDA ($5F),Y
                STX $5F
                STA $60
                BNE LOOP11
OUT             JMP CARRET
;
;
;ROUTINE TO LIST BASIC KEYWORDS
;STORED IN A TABLE AT $A09E.
;
LOOP15          NOP
                BPL LOOP16
                CMP #$FF
                BEQ LOOP16
                BIT FLAG
                BMI LOOP16
                SEC
                SBC #$7F
                TAX
                STY FORPNT
                LDY #$FF
LOOP19          DEX
                BEQ LOOP17
LOOP18          INY
                LDA KEYWORD,Y
                BPL LOOP18
                BMI LOOP19
;
;PRINT KEYWORD TO SCREEN
;
LOOP17          INY
                LDA KEYWORD,Y
                BMI LOOP20
                JSR OUTDO
                BNE LOOP17
                JMP CARRET
;
;
;STORAGE FOR LINE LINK ADDRESS
;POSITION IN LINE,AND CHARACTER
;BEING SEARCHED FOR.AND ALSO
;BEGINNING OF TABLE WHERE TEXT
;IS STORED.
;
;
LINKLO          BYT 0
LINKHI          BYT 0
MATCH           BYT 0
COUNTLO         BYT 0
COUNTHI         BYT 0
;
STORAGE         BYT 0
;
;USES ANOTHER 95 BYTES TO HOLD
;THE TEXT TO BE SEARCHED FOR.
;
```

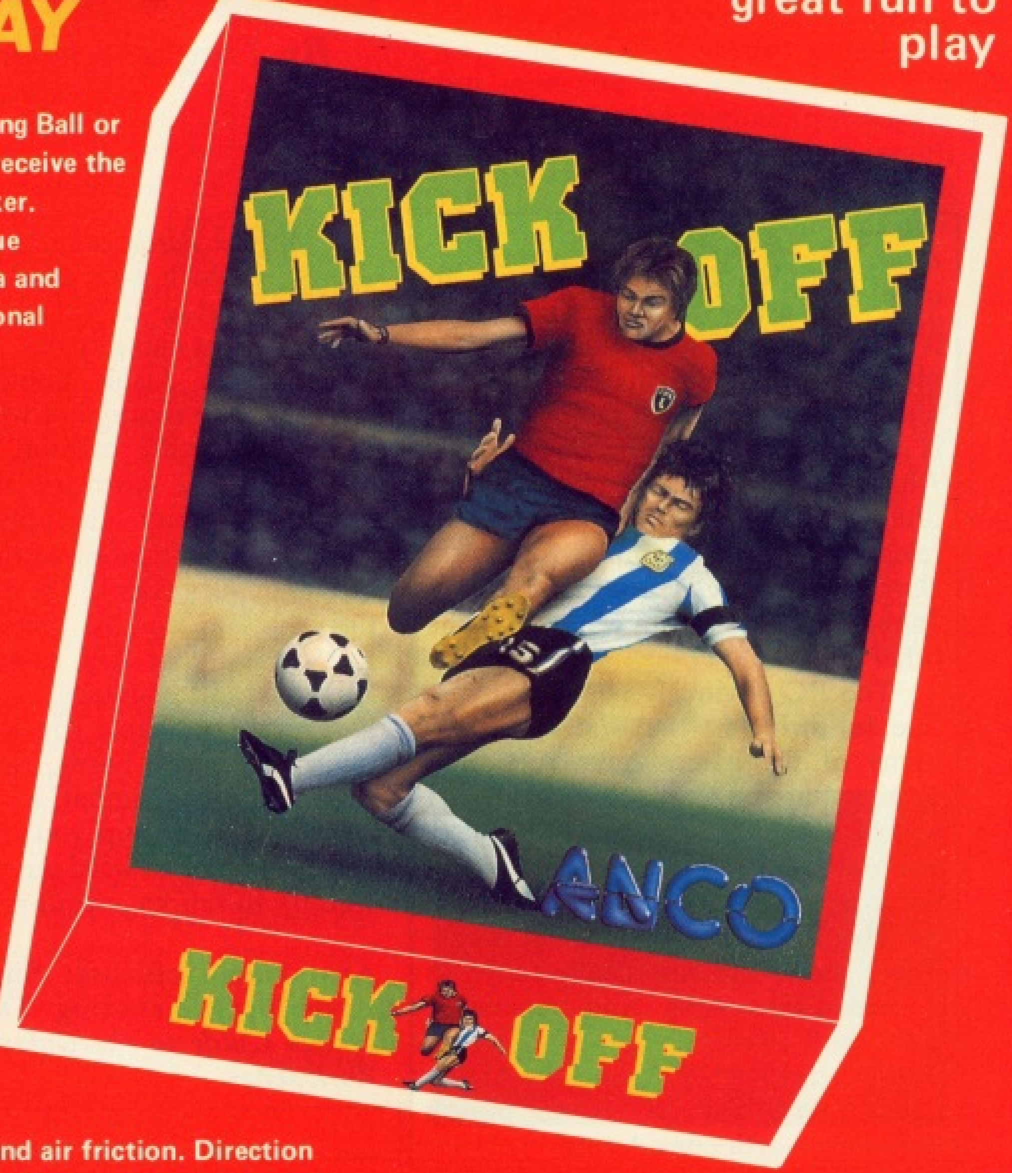


KICK OFF



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A Soccer Simulator which is not only accurate and realistic but is also great fun to play



Whatever your style of play may be, be it playing the Long Ball or playing the Sweeper, your players will be in position to receive the passes, control the midfield and tackle an advancing striker. Each player on the field is an individual with a unique combination of four attributes - Pace, Accuracy, Stamina and Aggression. Watch out for the Brazilians at the International level, they are dynamite.

* Full size multi-directional scrolling pitch with scanner showing all the players on the field.

* Option to practice and learn ball control, take corners and practice penalties.

* 5 Skill levels, International to Sunday League. The levels of both teams set separately. The ultimate challenge is the defeat of the star studded team of Internationals by the Sunday League of no hopers. A super human test of skill and concentration.

* One or two players option. * 4 distinct tactics.

* League competition for 1 to 8 players. Load and Save League facilities.

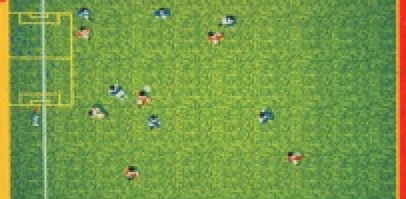
* Simple controls to dribble, shoot, pass, chip or head the ball or do a sliding tackle.

* Amazing ball simulation takes account of the ground and air friction. Direction changing breeze at the higher skill levels

* 9 types of Corner kicks, Penalties, Yellow and Red cards and a host of other features like players getting tired by the end of the game, time wasting, injury time, etc.

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CBM 64 Disk	£14.95
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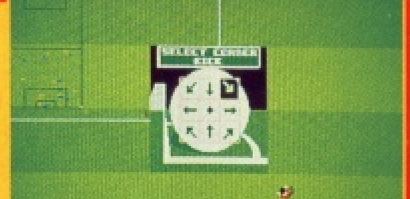
PLAYING IT IS EASY
MASTERING IT WILL TAKE TIME - A LOT OF TIME



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PC Games

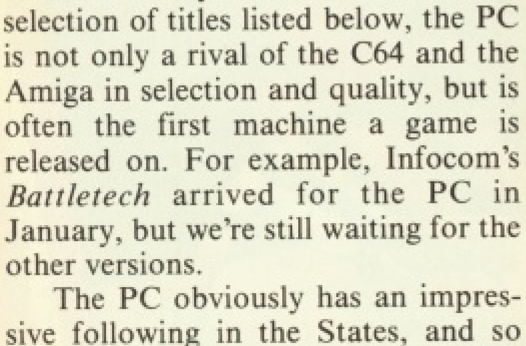
The PC is now a serious rival of the Amiga and C64 in the games machine race, and it's getting more popular all the time

By Tony Hetherington

The IBM PC (and its compatibles, that now include an extensive range of CBM PCs) is rapidly staking its claim as a games machine. As you will see from the selection of titles listed below, the PC is not only a rival of the C64 and the Amiga in selection and quality, but is often the first machine a game is released on. For example, Infocom's *Battletech* arrived for the PC in January, but we're still waiting for the other versions.

The PC obviously has an impressive following in the States, and so many of the games have American origins, but are now beginning to find a niche over here. So at last, PC owners can put aside their spreadsheets and databases and play a game.

The PC tends to attract strategy-based games that are ideally suited to a hard disk system. And remember, a PC hard disk costs only £200, which is only a third of the price of the Amiga counterpart. The PC is an option definitely worth considering.



Battletech/Infocom (Activision)

Without doubt, *Battletech* is one of the best strategy, combat and role-playing games you will ever play on computer, and marks Infocom's transition from text-only adventures to full role-playing games. The game is based on the *Battletech* series of board games, in which giant mechs (fighting machines) slug it out with lasers, machine guns and missiles.

You play Jason Youngblood, a young trainee mech pilot who is faced with a desperate mission when the deadly Kurita warriors attack and destroy your city. The only hope for your Lyran Commonwealth is to find the other survivors of the attack, and then track down the secret store of mech parts that will enable you to launch a counter-attack.

During the game you will have to infiltrate enemy bases, fight enemy mechs in open combat, learn how to repair and patch up your mechs and party, and how to weed out the traitors who try to sabotage your mission.

Also from Infocom: Superb text adventures including *The Hitch-Hikers Guide to the Galaxy* and the *Zork* series.

Pool of Radiance/SSI (US Gold)

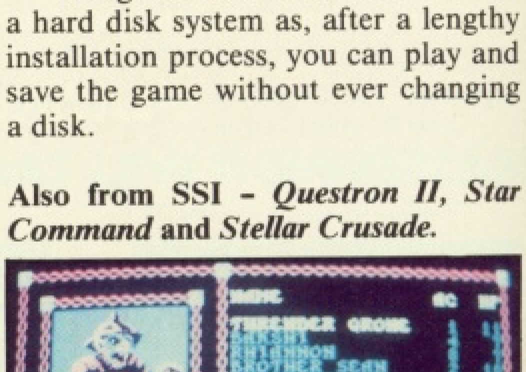
Dungeons and Dragons is *the* cult role-playing game, and so it was inevitable that there would be a computer game. Despite heavy competition, SSI won the rights to do it. *Pool of Radiance* was the first computer role-playing game and, after an initial learning stage, is unbeatable. Here at last is the game system you always wanted to play, with the character classes, monsters and spells that other systems copied, and all the original's characteristics of strength, intelligence and so on.

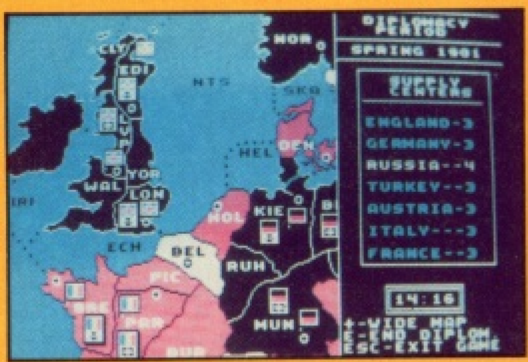
The combat system can at first seem very slow, especially when you're up against an army of orcs, but this soon grows on you as it gives you time to define and carry out your own strategy and tactics. This becomes vital when your magic users become strong enough to start hurling around fireballs and lightning bolts.

What I particularly like about *Pool of Radiance* are the unexpected surprises that it throws at you – just when you think you've got on top of things and your confidence is growing, a trap, a monster or some other equally unpleasant situation puts you in your place.

The game also shows the value of a hard disk system as, after a lengthy installation process, you can play and save the game without ever changing a disk.

Also from SSI – *Questron II, Star Command* and *Stellar Crusade.*





Diplomacy/Leisure Genius

Here's another game that's become a computer game, but this time

your aim is to lie, cheat and deceive your opponents. You control one of the major powers in Europe, circa 1870, and must use your limited armies and fleets to take control of the continent's supply centres and complete your domination of the world.

Unfortunately, six other human or computer players have exactly the same aims and ambitions. The only way to succeed is to back up your military might with deals and alliances, and the instinct to know when to stab your allies in the back just before they plan to do it to you.

You only have two moves a year, so you can't afford to make any mistakes in a game with secret orders and simultaneous movement, conflict and compromise. It's the odds that make the game so intriguing – seven players (at least one computer controlled) and only one winner, but you can't win on your own. It's this that forces you into alliances with your enemies and to double cross your friends.

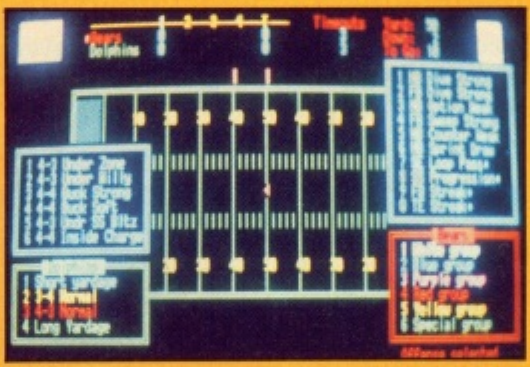
The Games – *Summer Edition*/Epyx (US Gold)



Eight events form the latest in the *"Games"* series of games that play just as well on the PC as they do on other machines. This time it's the turn of the summer Olympic events that weren't covered in *Summer Games I* and *II*, including diving, 400 metres hurdles (C64 owners only 100 metres), velodrome cycling (that means it's indoor), hammer throw, pole vault, archery and the two tough gymnastic events – the rings and the unparallel bars.

Up to eight players can compete for the gold, silver and bronze medals in the latest of a series that seems to have no end. This latest version, which was released in the winter, boasts improved 3D graphics to enhance the already remarkable gameplay.

Also from Epyx – *California Games, World Games, Winter games,* etc.



NFL Challenge/Xor Corporation

A must for fans of football American-style. This imported game is perhaps the best simulation of NFL Football to date. The program contains actual statistics for all 28 NFL teams, and a selection of plays that leaves other games on the bench.

NFL Challenge puts you firmly in place as Head Coach and gives you the chance to call all the plays, but leaves the players to carry them out. This gives you the chance to feel the glory when long passes are caught for touchdowns, and the misery when the ball is turned over by a fumble.

You can play against either a human or computer opponent, and control all team selection and substitution either for tactical reasons or to fill gaps left by injured players.

Whatever the call, the players line up and carry out the plays decided by their coaches, but only as representations (Os and Xs) on the screen.

Also from Xor – Update disks to keep the teams stats up to date.

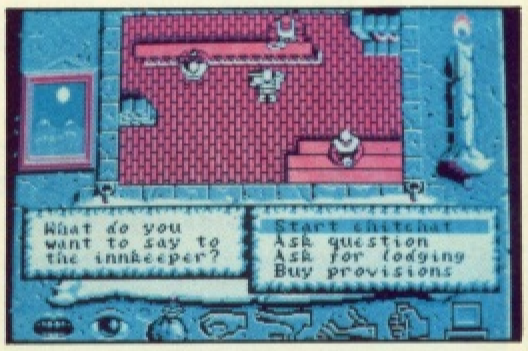
Times of Lore/Origin (Microprose)

This was one of the better attempts to bring role-playing games to the masses through combining the depth and scope of a role-playing world with the speed and reactions of arcade games.

You begin the game in a tavern knowing nothing of what lies ahead, but soon you become immersed in a quest to save the kingdom from hordes of barbarians attacking from the south and orcs invading from the north. All your actions are controlled by joystick movement, icon selection and choosing between phrases to control conversations – in this game you must talk to people as well as killing monsters.

Your first task takes you on a raid to retrieve a magic item stolen by the orcs in which you must fight your way through their guards and creep up on the camp site before striking. It's the need to organise your actions and the enemies you face that sets this game apart from all the other so-called arcade adventures.

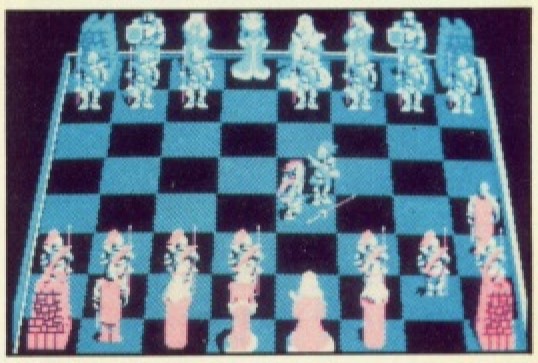
Also from Origin Systems – *Ultima V*.

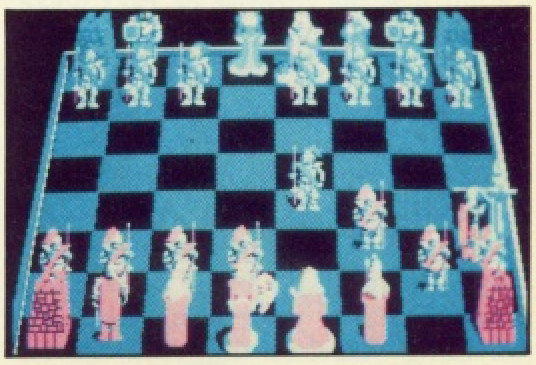


Battle Chess/Interplay (Electronic Arts)

Take a classic old game like chess (and they don't come much older) add some pretty graphics and animation and you've got a winner. It sounds unlikely, but that's exactly what happened when Interplay produced *Battle Chess*, a software classic.

It's a program well known to Amiga owners, but is also available for the PC. It plays an average game of chess, but when one piece takes another they fight for the space with some surprising results. For example, the rooks turn into giant stone monsters that pummel their opponents, while the Queen has an impressive array of magical powers, not to mention a wonderfully feline walk!





Joan of Arc/Chip (US Gold)

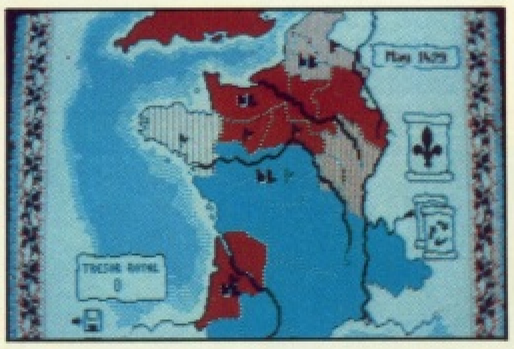
Joan of Arc is a must for strategy gamers who crave power, as it crowns you king of France. Your only problem is that English forces and their treacherous allies occupy half of France. Your job is to turf them out through skill on the battlefield, sword-play, diplomatic skills and regal justice.

At your disposal you have generals (your best is Joan) to take charge of your armies, spies to infiltrate and assassinate your enemies, politicians to talk to and deal with your adversaries, provinces to tax to raise the money to build armies, and executioners to keep order and punish traitors.

The game uses action sequences to determine the outcome of battles and sieges. In these battles you use mouse, joystick or keyboard control to scale ladders, pour boiling oil on invaders, challenge soldiers to duels and lead a cavalry charge on a battlefield.

Joan of Arc features some stunning graphics, a novel setting, a good strategy base and playable arcade sequences that directly affect the course of the game where money, power, subterfuge, military might and diplomacy are of equal importance.

Also from US Gold – *Heroes of the Lance* and *PC Gold Hits* (including *Leader Board*).



Wasteland/Interplay (Electronic Arts)

This was the surprise of 1988 when it appeared on the C64 in its 8 disk sides format. Set in a post-holocaust environment, you must patrol what's left of civilization as a Ranger and battle with mutants and outlaws in a very unfriendly world.

Part of the fun of this slick role-playing game is to build up a party armed with a variety of weapons (anything you can find) and devise battle tactics to use their strengths and protect their weaknesses. However, that's not all – there are also puzzles to solve, people to kill and mankind (for what's left of it) to save.



Apart from saving the world and taking out anything or anybody that gets in your way, you must organise raids on gang headquarters to rescue kidnapped mayors, find lost children and rid farmers of the mutants that plague them. If you do all this you may be rewarded with some food, weapons or even a new party member.

The game reflects *The Bard's Tale* style of role-playing, but it's nice to fight mutants for a change, instead of the usual selection of orcs and zombies.

Also from Interplay – *Bard's Tale I* and *II*.

F19/Microprose

Flight simulators have a special significance for PC owners, as using the Microsoft Simulator became the recognised way of testing whether a PC compatible was actually compatible.

Even in terms of PC flight simulators this is something special, as it gives you the chance to fly a fighter the US airforce won't even talk about. It makes you wonder whether the Kremlin has a PC!

The Stealth Fighter can be launched from either land bases or aircraft carriers, and fly missions around America's favourite warzones – that is, Libya, the Persian Gulf, the North Cape and Central Europe. Apart from the incredible attention to detail and the pile of info and overlays you are given to help you fly the plane, the game gives you a choice of screen views that includes the usual cockpit view, as well as TactiVue, which displays you and the target on the screen, SlotVue lets you see the plane and the flight path, but without the gauges and TrakCam that magnifies targets for a better view of the action.

There's a choice of promotions and medals for those who survive the missions, so what more could you want?

Also from Microprose – *Gunship, Silent Service, Airborne Ranger* and *Pirates.*



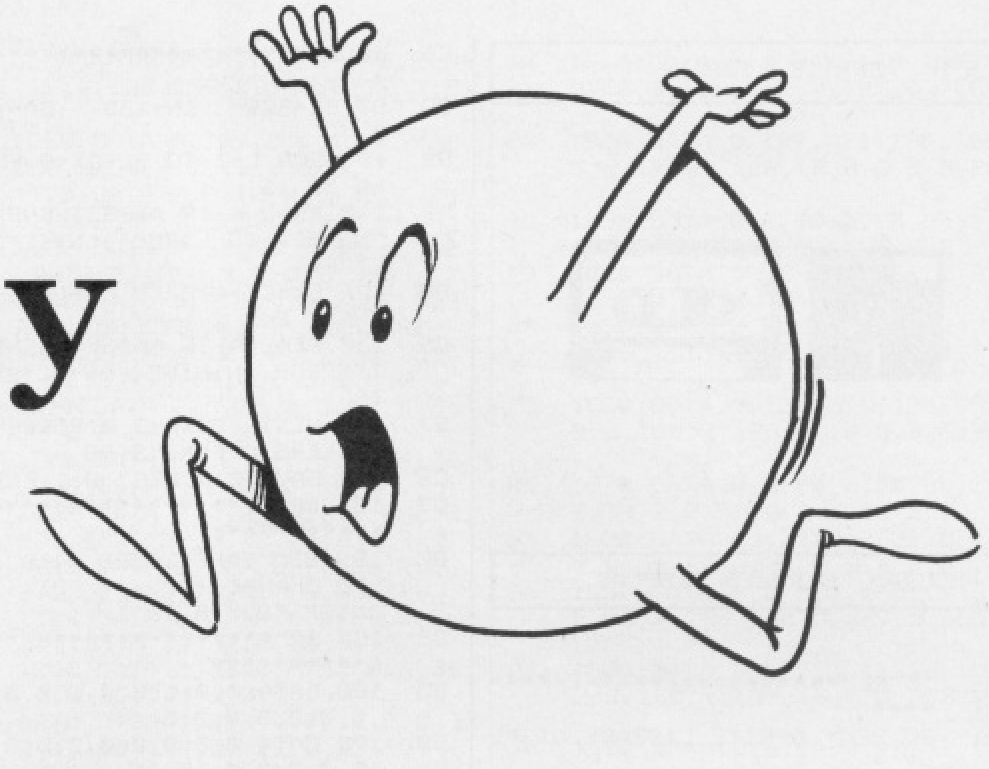
Hardware requirements

The Commodore range of PCs is *just* one of many so called IBM compatibles. They're compatible because IBM set the standard. However, it's a very curious standard as there are two different disk sizes, three different processors, three different standard memory configurations and four types of graphics display! The result of all this is that most games have a label somewhere on them that says something like this:

IBM, PC, XT, AT, Compag Tandy 1000 series, 3000, 4000, 512K; Supports CGA, EGA, VGA, Hercules graphics, Supports hard disk, required DOS 2.0 or higher. Joystick supported.

When buying a PC, it's important to check that it works with your system, because some won't. Check that you have the required memory, and turn off any memory resident programs such as Sidekick. Check also that your graphics card is listed – if it isn't it won't be supported – and finally take a careful look at whether a hard disk or twin floppy drives are supported or required.

Sprite Library



This month, Mike Benn shows how to run rings round sprites

This month we're going to run circles around the sprites. The CIRCLES sprites can be used as individual sequences; for example, the growing circle animation, if run backwards, will create the effect of a pebble being dropped in water. Alternatively, you can overlay one sprite over the other; the two dials if overlayed will produce a clock effect. Another useful effect is to expand the x axis of the sprite, which will give the illusion of 3D.

Table (Circle - Hires)

HEX	DECIMAL	DESCRIPTION
A0 - A4	160 - 164	Growing circle
A4 - AA	164 - 170	Rotate through Y axis
AA - B0	170 - 176	Rotate through X axis
B1 - BC	177 - 188	Dial large hand (clockwise)
BD - C8	189 - 200	Dial small hand (clockwise)
C9 - D4	201 - 212	Disappearing Pie
D5 - D7	213 - 215	Turning windmill sail
D8 - D9	216 - 217	Turning spoked wheel
DA	218	Globe
DB	219	Ying Yang
DC - DF	220 - 223	Turning arrow

Getting it all in

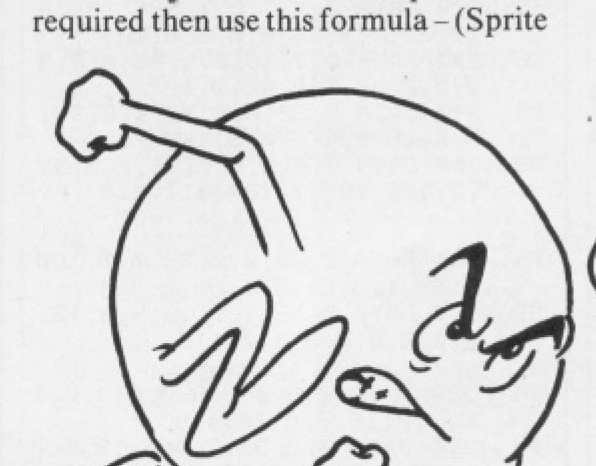
Type in the basic loader as published, and SAVE IT - DON'T RUN IT, or it will self-destruct. Before running the loader program, you'll need to reset the computer and type directly the following - POKE43, 0:POKE44, 64:POKE16384, 0:NEW and press return.

This will trick the computer into believing that the Basic now starts at $4000 instead of $0801. Load in the Basic loader and run it; if error free, the program will automatically save itself as a block of data. If you reload that data in the future, remember to add a 1 after the device number. The data is saved in the following location $2800-$37FF.

The sprites run from 160 to 223 in a compromise to avoid the area $2000, traditionally set aside for re-defined character graphics, and to avoid the need for typing in line after line of data.

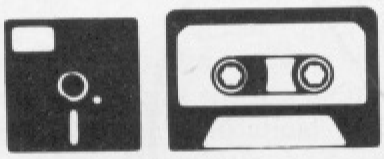
If only one or two sprites are required then use this formula - (Sprite block No. -160) *40 + 190 = the data line number at which that sprite blocks data starts. Remember to type in the following three lines of data, and alter the variable BL to the number of data lines you have in your finished program, less 1.

The small Basic program CIRCLES DISPLAY will variously animate the sprites in both non-expanded and expanded forms on the screen simultaneously. To hold on any sprite, enter the same number for Start and End. Any Sprite Editor program will enable you to change and adapt the individual sprites to your own requirements.





S/H SPRITE LIBRARY



PROGRAM: CIRCLES DISPLAY

```
85  10 REM**********************
    ****
31  20 REM* SPRITE LIRBARY DISPL
    AY *
06  30 REM*         CIRCLES
    *
CB  40 REM**********************
    ****
38  50 POKE55,0:POKE56,40:X=X+1:
    IFX=1THENLOAD"CIRCLES",8,1
5A  60 V=53248:PRINT"[CLS][BLU][
    26CD][9CR][REV]F7 TO STOP AN
    IMATION"
2C  70 POKEV+21,15:POKEV+23,10:P
    OKEV+29,12:POKEV+32,1:POKEV+
    33,1:POKEV+39,0
40  80 POKEV+40,0:POKEV+41,0:POK
    EV+42,0:POKEV,70:POKEV+1,150
    :POKEV+2,120:POKEV+3,150
5A  90 POKEV+4,170:POKEV+5,150:P
    OKEV+6,248:POKEV+7,150
8D  100 INPUT"[HOM][CD]START SPR
    ITE";S:INPUT"END SPRITE";E:I
    NPUT"DELAY";D
4C  110 FORSP=STOE:FORT=0TOD:NEX
    T:PRINT"[HOM]"TAB(23)"SPRITE
     NO.=";SP:POKE2040,SP
87  120 POKE2041,SP:POKE2042,SP:
    POKE2043,SP:NEXT:GETK$:IFK$=
    "[F7]"THEN100
3D  130 GOTO110
```

PROGRAM: CIRCLES DATA

```
AF  10 REM**********************
    *
4B  20 REM*    SPRITE LIRBARY
    
A3  30 REM*    --------------
    *
F0  40 REM*  CIRCLES   SPRITES
    *
CE  50 REM*  BASIC DATA LOADER
    *
99  60 REM* SPRITES DESIGNED BY
    *
2E  70 REM*      MIKE BENN
    *
C5  80 REM***********************
    *
DD  90 BL=255   :LN=190   :SA=1024
    0
89  100 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15
4F  110 READ A:IF A>255THENPRINT
    "NUMBER TO LARGE";LN+(L*10):
    STOP
98  120 CX=CX+A:POKE SA+L*16+D,A
    :NEXT D
D9  130 READ A:IF A<>CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
37  140 NEXTL:POKE43,0:POKE44,40
    :POKE45,0:POKE46,56
C2  150 SAVE"CIRCLES",8,1:END
D7  152 REM**********************
    ************
DC  155 REM TAPE USERS WILL HAVE
     TO CHANGE          DEVICE N
    UMBER FROM 8 TO 1
D2  157 REM**********************
    ***********
33  160 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
59  170 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,16,16
27  180 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
93  190 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,238,238
1B  200 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
50  210 DATA 0,0,0,0,0,0,0,0,0,2
    8,0,0,34,0,0,34,96
06  220 DATA 0,0,34,0,0,28,0,0,0
    ,0,0,0,0,0,0,0,62
C5  230 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,251,251
63  240 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
7F  250 DATA 124,0,1,131,0,2,0,1
    28,2,0,128,4,0,64,4,0,588
C1  260 DATA 64,4,0,64,2,0,128,2
    ,0,128,1,131,0,0,124,0,648
5C  270 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
84  280 DATA 0,0,0,0,0,0,0,56,0,
    0,198,0,3,1,128,4,390
F5  290 DATA 0,64,4,0,64,8,0,32,
    16,0,16,16,0,16,16,0,252
51  300 DATA 16,16,0,16,8,0,32,4
    ,0,64,4,0,64,3,1,128,356
EC  310 DATA 0,198,0,0,56,0,0,0,
    0,0,0,0,0,0,0,20,274
2F  320 DATA 0,127,0,1,128,192,2
    ,0,32,4,0,16,8,0,8,8,526
96  330 DATA 0,8,16,0,4,32,0,2,3
    2,0,2,32,0,2,32,0,162
05  340 DATA 2,32,0,2,32,0,2,32,
    0,2,16,0,4,8,0,8,140
C8  350 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,1,519
F4  360 DATA 0,28,0,0,99,0,0,128
    ,128,1,0,64,2,0,32,2,484
9B  370 DATA 0,32,4,0,16,4,0,16,
    8,0,8,8,0,8,8,0,112
91  380 DATA 8,8,0,8,8,0,8,4,0,1
    6,4,0,16,2,0,32,114
F1  390 DATA 2,0,32,1,0,64,0,128
    ,128,0,99,0,0,28,0,145,627
39  400 DATA 0,8,0,0,20,0,0,34,0
    ,0,34,0,0,65,0,0,161
76  410 DATA 65,0,0,65,0,0,128,1
    28,0,128,128,0,128,128,0,128
    ,1026
4E  420 DATA 128,0,128,128,0,128
    ,128,0,128,128,0,65,0,0,65,0
    ,1026
A2  430 DATA 0,65,0,0,34,0,0,34,
    0,0,20,0,0,8,0,229,390
E6  440 DATA 0,8,0,0,8,0,0,8,0,0
    ,8,0,0,8,0,0,40
CC  450 DATA 8,0,0,8,0,0,8,0,0,8
    ,0,0,8,0,0,8,48
32  460 DATA 0,0,8,0,0,8,0,0,8,0
    ,0,8,0,0,8,0,40
F0  470 DATA 0,8,0,0,8,0,0,8,0,0
    ,8,0,0,8,0,109,149
89  480 DATA 0,8,0,0,20,0,0,34,0
    ,0,34,0,0,65,0,0,161
26  490 DATA 65,0,0,65,0,0,128,1
    28,0,128,128,0,128,128,0,128
    ,1026
7E  500 DATA 128,0,128,128,0,128
    ,128,0,128,128,0,65,0,0,65,0
    ,1026
19  510 DATA 0,65,0,0,34,0,0,34,
    0,0,20,0,0,8,0,118,279
17  520 DATA 0,28,0,0,99,0,0,128

    ,128,1,0,64,2,0,32,2,484
98  530 DATA 0,32,4,0,16,4,0,16,
    8,0,8,8,0,8,8,0,112
82  540 DATA 8,8,0,8,8,0,8,4,0,1
    6,4,0,16,2,0,32,114
92  550 DATA 2,0,32,1,0,64,0,128
    ,128,0,99,0,0,28,0,144,626
E4  560 DATA 0,127,0,1,128,192,2
    ,0,32,4,0,16,8,0,8,8,526
33  570 DATA 0,8,16,0,4,32,0,2,3
    2,0,2,32,0,2,32,0,162
3A  580 DATA 2,32,0,2,32,0,2,32,
    0,2,16,0,4,8,0,8,140
0F  590 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,97,615
89  600 DATA 0,0,0,0,0,0,0,62,0,
    0,193,128,3,0,96,4,486
C0  610 DATA 0,16,8,0,8,16,0,4,1
    6,0,4,32,0,2,32,0,138
AD  620 DATA 2,32,0,2,16,0,4,16,
    0,4,8,0,8,4,0,16,112
94  630 DATA 3,0,96,0,193,128,0,
    62,0,0,0,0,0,0,0,140,622
D1  640 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
36  650 DATA 0,0,0,127,0,3,128,2

    24,12,0,24,16,0,4,32,0,570
D6  660 DATA 2,16,0,4,12,0,24,3,
    128,224,0,127,0,0,0,0,540
B7  670 DATA 0,0,0,0,0,0,0,0;0,0
    ,0,0,0,0,0,223,223
39  680 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
DA  690 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,63,255,318
B3  700 DATA 254,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,254
63  710 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,186,186
01  720 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
06  730 DATA 0,0,0,127,0,3,128,2
    24,12,0,24,16,0,4,32,0,570
C6  740 DATA 2,16,0,4,12,0,24,3,
    128,224,0,127,0,0,0,0,540
9D  750 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,21,21
E9  760 DATA 0,0,0,0,0,0,0,62,0,
    0,193,128,3,0,96,4,486
```

```
0F  770 DATA 0,16,8,0,8,16,0,4,1
    6,0,4,32,0,2,32,0,138
B2  780 DATA 2,32,0,2,16,0,4,16,
    0,4,8,0,8,4,0,16,112
D1  790 DATA 3,0,96,0,193,128,0,
    62,0,0,0,0,0,0,0,46,528
DD  800 DATA 0,127,0,1,128,192,2
    ,0,32,4,0,16,8,0,8,8,526
30  810 DATA 0,8,16,0,4,32,0,2,3
    2,0,2,32,0,2,32,0,162
4B  820 DATA 2,32,0,2,32,0,2,32,
    0,2,16,0,4,8,0,8,140

23  830 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,242,760
67  840 DATA 0,127,0,1,136,192,2
    ,8,32,4,8,16,8,8,8,8,558
9B  850 DATA 8,8,16,8,4,32,8,2,3
    2,8,2,32,0,2,32,8,202
B3  860 DATA 2,32,0,2,32,0,2,32,
    0,2,16,0,4,8,0,8,140
45  870 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,109,627
B0  880 DATA 0,127,0,1,136,192,2
    ,8,32,4,1,16,8,1,8,8,544
BA  890 DATA 2,8,16,2,4,32,4,2,3
    2,4,2,32,0,2,32,8,182
5B  900 DATA 2,32,0,2,32,0,2,32,
    0,2,16,0,4,8,0,8,140
CD  910 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,119,637
6C  920 DATA 0,127,0,1,136,192,2
    ,8,32,4,0,16,8,0,8,8,542
78  930 DATA 0,8,16,0,36,32,0,66
    ,32,1,130,32,2,2,32,8,397
03  940 DATA 2,32,0,2,32,0,2,32,
    0,2,16,0,4,8,0,8,140
DB  950 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,252,770
E4  960 DATA 0,127,0,1,136,192,2
    ,8,32,4,0,16,8,0,8,8,542
EC  970 DATA 0,8,16,0,4,32,0,2,3
    2,0,2,32,0,2,32,11,173
38  980 DATA 250,32,0,2,32,0,2,3
    2,0,2,16,0,4,8,0,8,388
83  990 DATA 8,0,8,4,0,16,2,0,32
    ,1,128,192,0,127,0,243,761
1C  1000 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
1F  1010 DATA 0,8,16,0,4,32,0,2,
    32,0,2,32,0,2,32,8,170
E0  1020 DATA 2,32,2,2,32,1,130,
    32,0,66,16,0,36,8,0,8,367
18  1030 DATA 8,0,8,4,0,16,2,0,3
    2,1,128,192,0,127,0,116,634
B9  1040 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
8A  1050 DATA 0,8,16,0,4,32,0,2,
    32,0,2,32,0,2,32,8,170
83  1060 DATA 2,32,0,2,32,4,2,32
    ,4,2,16,2,4,8,2,8,152

8E  1070 DATA 8,1,8,4,1,16,2,0,3
    2,1,128,192,0,127,0,51,571
71  1080 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
C2  1090 DATA 0,8,16,0,4,32,0,2,
    32,0,2,32,0,2,32,8,170
81  1100 DATA 2,32,0,2,32,8,2,32
    ,8,2,16,8,4,8,8,8,172
FF  1110 DATA 8,8,8,4,8,16,2,8,3
    2,1,128,192,0,127,0,95,637
E9  1120 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
9A  1130 DATA 0,8,16,0,4,32,0,2,

    32,0,2,32,0,2,32,8,170
78  1140 DATA 2,32,0,2,32,16,2,3
    2,16,2,16,32,4,8,32,8,236
C6  1150 DATA 8,64,8,4,64,16,2,0
    ,32,1,128,192,0,127,0,70,716
21  1160 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
52  1170 DATA 0,8,16,0,4,32,0,2,
    32,0,2,32,0,2,32,8,170
21  1180 DATA 2,32,32,2,32,192,2
    ,33,0,2,18,0,4,8,0,8,367
2A  1190 DATA 8,0,8,4,0,16,2,0,3
    2,1,128,192,0,127,0,24,542
59  1200 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
4C  1210 DATA 0,8,16,0,4,32,0,2,
    32,0,2,32,0,2,47,232,409
F8  1220 DATA 2,32,0,2,32,0,2,32
    ,0,2,16,0,4,8,0,8,140
65  1230 DATA 8,0,8,4,0,16,2,0,3
    2,1,128,192,0,127,0,231,749
11  1240 DATA 0,127,0,1,136,192,
    2,8,32,4,0,16,8,0,8,8,542
79  1250 DATA 0,8,18,0,4,33,0,2,
    32,192,2,32,32,2,32,8,397
E0  1260 DATA 2,32,0,2,32,0,2,32
    ,0,2,16,0,4,8,0,8,140
C0  1270 DATA 8,0,8,4,0,16,2,0,3
    2,1,128,192,0,127,0,33,551
9A  1280 DATA 0,127,0,1,136,192,
    2,8,32,4,64,16,8,64,8,8,670
27  1290 DATA 32,8,16,32,4,32,16
    ,2,32,16,2,32,0,2,32,8,266
49  1300 DATA 2,32,0,2,32,0,2,32
    ,0,2,16,0,4,8,0,8,140
45  1310 DATA 8,0,8,4,0,16,2,0,3
    2,1,128,192,0,127,0,48,566
68  1320 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800
D1  1330 DATA 8,8,20,8,20,34,8,3
    4,32,8,2,32,0,2,56,8,280
AF  1340 DATA 14,32,0,2,32,0,2,3
    4,0,34,20,0,20,8,0,8,206
AA  1350 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,7,862

40  1360 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

76  1370 DATA 0,8,20,2,20,34,4,3
    4,32,4,2,32,0,2,56,8,258
27  1380 DATA 14,32,0,2,32,0,2,3
    4,0,34,20,0,20,8,0,8,206
40  1390 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,129,9
    84
F8  1400 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800
5D  1410 DATA 0,8,20,0,20,34,0,3
    4,32,1,130,32,2,2,56,8,379
BF  1420 DATA 14,32,0,2,32,0,2,3
    4,0,34,20,0,20,8,0,8,206
7B  1430 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,131,9
    86
10  1440 DATA 0,127,0,1,136,192,
    3.8.160.4.129.16,8,0,8,8,800
41  1450 DATA 0,8,20,0,20,34,0,3
    4,32,0,2,32,0,2,56,11,251
72  1460 DATA 206,32,0,2,32,0,2,
    34,0,34,20,0,20,8,0,8,398
F1  1470 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,103,9
    58
48  1480 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

A5  1490 DATA 0,8,20,0,20,34,0,3
    4,32,0,2,32,0,2,56,8,248
43  1500 DATA 14,32,2,2,32,1,130
    ,34,0,34,20,0,20,8,0,8,337
8A  1510 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,7,862
20  1520 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

2D  1530 DATA 0,8,20,0,20,34,0,3
    4,32,0,2,32,0,2,56,8,248
F3  1540 DATA 14,32,0,2,32,4,2,3
    4,4,34,20,2,20,8,0,8,216
2A  1550 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,161,1
    016
F7  1560 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

6E  1570 DATA 0,8,20,0,20,34,0,3
    4,32,0,2,32,0,2,56,8,248
89  1580 DATA 14,32,0,2,32,8,2,3
    4,8,34,20,8,20,8,8,8,238
7A  1590 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,254,1
    109
AF  1600 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

76  1610 DATA 0,8,20,0,20,34,0,3
    4,32,0,2,32,0,2,56,8,248
12  1620 DATA 14,32,0,2,32,16,2,
    34,16,34,20,32,20,8,0,8,270
D1  1630 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,167,1
    022
87  1640 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

FE  1650 DATA 0,8,20,0,20,34,0,3

    4,32,0,2,32,0,2,56,8,248
66  1660 DATA 14,32,32,2,32,192,
    2,34,0,34,20,0,20,8,0,8,430
B6  1670 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,153,1
    008
3F  1680 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

44  1690 DATA 0,8,20,0,20,34,0,3
    4,32,0,2,32,0,2,57,232,473
80  1700 DATA 14,32,0,2,32,0,2,3
    4,0,34,20,0,20,8,0,8,206
E4  1710 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,57,91
    2
57  1720 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

58  1730 DATA 0,8,20,0,20,34,0,3
    4,32,192,2,32,32,2,56,8,472
18  1740 DATA 14,32,0,2,32,0,2,3
    4,0,34,20,0,20,8,0,8,206
12  1750 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,217,1
    072
8F  1760 DATA 0,127,0,1,136,192,
    3,8,160,4,129,16,8,0,8,8,800

E7  1770 DATA 0,8,20,32,20,34,16
    ,34,32,16,2,32,0,2,56,8,312
D0  1780 DATA 14,32,0,2,32,0,2,3

    4,0,34,20,0,20,8,0,8,206
3E  1790 DATA 8,0,8,4,128,144,3,
    8,96,1,136,192,0,127,0,153,1
    008
F6  1800 DATA 0,127,0,0,255,128,
    3,255,224,7,255,240,15,255,2
    48,15,2027
6B  1810 DATA 255,248,31,255,252
    ,31,255,252,63,255,254,63,25
```

```
     5,254,63,255,3041
0F   1820 DATA 254,63,255,254,63,
     255,254,31,255,252,31,255,25
     2,15,255,248,2992
46   1830 DATA 15,255,248,7,255,2
     40,3,255,224,0,255,128,0,127
     ,0,222,2234
DE   1840 DATA 0,112,0,0,240,64,3
     ,240,224,7,241,240,15,241,24
     8,15,1890
BB   1850 DATA 243,248,31,243,252
     ,31,247,252,63,247,254,63,24
     7,254,63,255,2993
D7   1860 DATA 254,63,255,254,63,
     255,254,31,255,252,31,255,25
     2,15,255,248,2992
5A   1870 DATA 15,255,248,7,255,2
     40,3,255,224,0,255,128,0,127
     ,0,223,2235
1B   1880 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
40   1890 DATA 240,24,31,240,60,3
     1,240,124,63,241,254,63,243,
     254,63,247,2418
3F   1900 DATA 254,63,255,254,63,
     255,254,31,255,252,31,255,25
     2,15,255,248,2992
06   1910 DATA 15,255,248,7,255,2
     40,3,255,224,0,255,128,0,127
     ,0,226,2238
D3   1920 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
F8   1930 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
2E   1940 DATA 0,63,255,254,63,25
     5,254,31,255,252,31,255,252,
     15,255,248,2738
8C   1950 DATA 15,255,248,7,255,2
     40,3,255,224,0,255,128,0,127
     ,0,70,2082
CB   1960 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
A0   1970 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
C8   1980 DATA 0,63,252,0,63,255,
     0,31,255,128,31,255,192,15,2
     55,224,2019
13   1990 DATA 15,255,240,7,255,2
     40,3,255,224,0,255,128,0,127
     ,0,210,2214
83   2000 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
68   2010 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
75   2020 DATA 0,63,240,0,63,248,
     0,31,252,0,31,252,0,15,254,0
     ,1449
AF   2030 DATA 15,254,0,7,255,0,3
     ,255,0,0,255,0,0,127,0,12,11
     83
3B   2040 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
83   2050 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
6D   2060 DATA 0,63,240,0,63,240,
     0,31,240,0,31,240,0,15,240,0
     ,1403
BA   2070 DATA 15,240,0,7,240,0,3
     ,240,0,0,240,0,0,112,0,201,1
     298
BC   2080 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
AB   2090 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
CA   2100 DATA 0,63,240,0,63,224,
     0,31,224,0,31,224,0,15,192,0
     ,1307
AD   2110 DATA 15,192,0,7,192,0,3
     ,128,0,0,128,0,0,0,94,759
34   2120 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
33   2130 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
B3   2140 DATA 0,63,224,0,63,128,
     0,30,0,0,24,0,0,0,0,0,532
01   2150 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,20,20
6C   2160 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,15,240,0,15,11
     12
9B   2170 DATA 240,0,31,240,0,31,
     240,0,63,240,0,63,240,0,63,2
     40,1691
DF   2180 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,0
39   2190 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,20,20
FB   2200 DATA 0,112,0,0,240,0,3,
     240,0,7,240,0,7,240,0,3,1092
BD   2210 DATA 240,0,1,240,0,0,24
     0,0,0,112,0,0,48,0,0,16,897
27   2220 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,0
95   2230 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,136,136
43   2240 DATA 0,112,0,0,240,0,1,
     240,0,1,240,0,0,240,0,0,1074
A5   2250 DATA 112,0,0,112,0,0,48
     ,0,0,48,0,0,16,0,0,16,352
0F   2260 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,0
7D   2270 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,5,5
3E   2280 DATA 0,0,0,1,128,192,2,
     128,160,4,65,16,8,65,8,8,785
E9   2290 DATA 34,8,4,34,8,3,20,4
     8,0,212,192,0,63,0,0,28,654
E2   2300 DATA 0,0,126,0,1,149,12
     8,6,20,96,24,34,16,16,34,8,6
     58
78   2310 DATA 8,65,8,4,65,16,2,1
     28,160,1,0,64,0,0,0,178,699
CE   2320 DATA 0,15,0,0,8,192,0,8
     ,32,4,8,16,10,8,32,9,342
3C   2330 DATA 8,64,16,136,128,32
     ,73,0,32,42,0,32,28,0,63,255
     ,909
D9   2340 DATA 254,0,28,2,0,42,2,
     0,73,2,0,136,132,1,8,72,752
16   2350 DATA 2,8,56,4,8,0,2,8,0
     ,1,136,0,0,120,0,226,571
0A   2360 DATA 0,127,0,0,128,128,
     0,128,128,0,65,0,0,65,0,0,76
     9
50   2370 DATA 34,0,24,34,12,38,2
     0,50,33,148,194,32,127,2,32,
     28,808
93   2380 DATA 2,32,127,2,33,148,
     194,38,20,50,24,34,12,0,34,0
     ,750
95   2390 DATA 0,65,0,0,65,0,0,12
     8,128,0,128,128,0,127,0,112,
     881
5A   2400 DATA 0,127,0,1,136,192,
     2,8,32,4,8,16,10,8,40,9,593
D4   2410 DATA 8,72,16,136,132,32
     ,73,2,32,42,2,32,28,2,63,255
     ,927
7C   2420 DATA 254,32,28,2,32,42,
     2,32,73,2,16,136,132,9,8,72,
     872
B7   2430 DATA 10,8,56,4,8,16,2,8
     ,32,1,136,192,0,127,0,91,691
BB   2440 DATA 0,127,0,1,128,192,
     2,128,160,4,65,16,8,65,8,8,9
     12
34   2450 DATA 34,8,20,34,12,35,2
     0,50,32,212,194,32,43,2,32,2
     8,788
72   2460 DATA 2,32,106,2,33,149,
     130,38,20,98,24,34,20,8,34,8
     ,738
75   2470 DATA 8,65,8,4,65,16,2,1
     28,160,1,128,192,0,127,0,224
     ,1128
D8   2480 DATA 0,127,0,1,172,192,
     2,107,32,4,156,144,13,8,88,1
     1,1057
15   2490 DATA 8,104,18,201,164,3
     4,62,34,36,8,18,36,8,18,63,2
     55,1067
91   2500 DATA 254,36,8,18,36,62,
     18,34,201,162,19,8,100,13,8,
     88,1065
F5   2510 DATA 8,136,72,4,92,144,
     2,107,32,1,152,192,0,127,0,2
     53,1322
50   2520 DATA 0,63,0,1,240,192,3
     ,224,32,7,192,16,15,128,8,15
     ,1136
C0   2530 DATA 0,8,31,0,4,63,0,2,
     63,128,2,63,224,2,63,252,905
28   2540 DATA 2,63,254,2,63,255,
     2,63,255,130,31,255,132,15,2
     55,136,1913
5D   2550 DATA 15,255,136,7,255,1
     6,3,254,32,1,252,192,0,127,0
     ,215,1760
EC   2560 DATA 0,16,0,0,8,0,0,60,
     0,0,200,0,1,16,0,2,303
A2   2570 DATA 0,0,2,0,0,4,0,0,8,
     0,0,8,0,0,8,0,30
27   2580 DATA 0,8,0,0,8,0,0,4,0,
     0,2,0,0,2,0,0,24
FD   2590 DATA 1,0,0,0,192,0,0,48
     ,0,0,0,0,0,0,0,48,289
33   2600 DATA 0,0,0,0,0,0,0,62,0
     ,0,193,128,1,0,64,2,450
4B   2610 DATA 0,32,2,0,32,4,0,16
     ,8,0,8,8,0,42,8,0,160
3C   2620 DATA 28,0,0,8,0,0,0,0,0
     ,0,0,0,0,0,0,0,36
FB   2630 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,64,64
56   2640 DATA 0,0,0,0,0,0,0,6,0,
     0,1,128,0,0,64,0,199
1F   2650 DATA 0,32,0,0,32,0,0,16
     ,0,0,8,0,0,8,0,0,96
D3   2660 DATA 8,0,0,8,0,0,8,0,0,
     16,0,0,32,0,0,32,104
F3   2670 DATA 0,4,64,0,9,128,0,3
     0,0,0,8,0,0,4,0,73,320
D1   2680 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,0
1E   2690 DATA 0,0,0,0,0,0,0,0,0,
     0,0,8,0,0,28,0,36
E1   2700 DATA 8,42,0,8,8,0,8,4,0
     ,16,2,0,32,2,0,32,162
BE   2710 DATA 1,0,64,0,193,128,0
     ,62,0,0,0,0,0,0,0,0,448
```

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DEMON'S WINTER





Although SSI were one of the first companies to start producing computerised role-playing games, they never really consolidated their initial advantage. To date, only *Pools of Radiance*, their officially licensed *Dungeons and Dragons* title, has been a particularly memorable game when compared with the likes of *Bard's Tale* and the *Ultima* series.

It was interesting then to take a look at their latest release, *Demon's Winter*, in order to see what steps they had taken to improve their image. The game contains several imaginative ideas and features not previously seen in CRPG's, but unfortunately there are still sufficient presentational problems to make any potential buyers wary. Playing the game, you soon come across several spelling mistakes which, apart from being totally inexcusable, I always feel augurs badly for the rest of the game. If you can't be bothered to check your spelling, what chance is there of the programming being 100 per cent perfect?

The hardest part of the game is actually getting started. It's blatantly obvious that you'll need to back up the disks (three sides) before you get anywhere, but it would have been nice to be told that. Instructions for all other versions contain this useful snippet of information, but not the C64 one. Again, you will need to have access to your own disk copier. The Apple version includes its own, so why not here?

As to the game itself, you are told precious little about your ultimate goal. Your village has been razed to the ground by marauding Kobolds, and you and your party go off in search of revenge. You can't help suspecting, though, that a Kobold is not going to be the most serious threat you come across, certainly in view of the game's title!

You can choose from one of five different races, including troll and dark elf, and each character can opt to follow one of ten different professions. Depending on how clever your character is, you can learn a variety of skills. At the start of the game, you can only learn two abilities. If you want any more, you have to find a college that is prepared to train you and pay the necessary fee.

Weapon skills are obviously a must, but you can also choose to specialise in hunting, tactics and various types of lore. If you tend towards the arcane arts, then there are a whole series of runes and chants that you can learn. Spirit runes are recommended, as these give access to all the healing spells for when one of your party gets injured in battle. This idea of using different skills brings considerably more variety into the game than the traditional approach, and means that you can usually overcome any blunders that you made when you first picked your party.

There are several different Gods and Shamans within the game, and each character can select which one he prays to. If you need help in the course of a tricky battle or whatever, then you can ask your deity to intervene on your behalf. This is a basic 20 per cent chance which reduces by 5 per cent each time you try, although you can top up your standing by worshipping in the appropriate temple.

One interesting feature of the game is the unusual

GAMES UPDATE



properties possessed by some of the weapons. As well as the usual combat bonuses, a sword might also have other constant powers such as giving you a new skill or improving an old one. Then there are powers which can be invoked, that is you decide when you want to call on them. For example, you may be able to call on a flame shield twice a day. Finally, the most powerful attributes are the dormant ones, the ones that the weapon itself decides when to use, including life stealing and berserking.

Demon's Winter follows the traditional hack and slash storyline. There are mini-quests to be undertaken, but these are let down somewhat by use of traps that kill off all your party instantly, so remember to save your game frequently. Control of the game is fairly straightforward, apart from the magic system which requires all spell names to be typed in full. Whatever happened to menus or abbreviations?

I started off convinced that I was not going to like *Demon's Winter*, but it soon grew on me, and I quickly became hooked. But all the time, the doubts nagged away. Why didn't they do this, or wouldn't it have been better to do it this way. In the end I decided that it was a good game, but with a bit more care it could have been a very good game.

Touchline:
Title: *Demon's Winter.* ***Supplier:*** *SSI via US Gold, Units 2/3 Holford Way, Holford, B6 7AX.* ***Tel:*** *021-356 3388.* ***Price:*** *£19.99.*

LAS VEGAS CASINO

Despite the title, *Las Vegas Casino* offers none of the excitement of the real thing. Here is your chance to lose pretend Monopoly money at four different games – roulette, black jack, baccarat and crap.

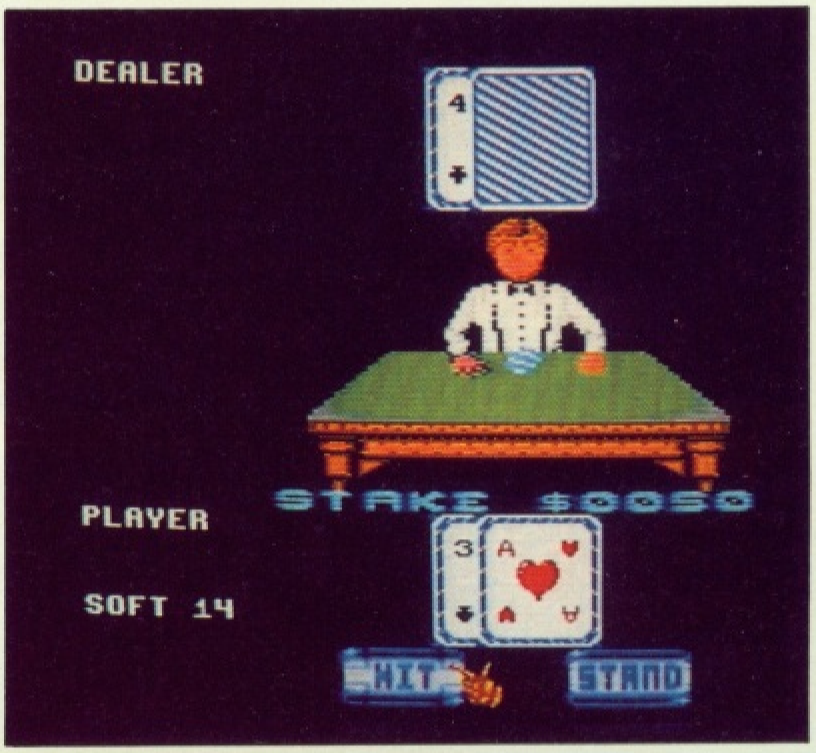
Starting with only 250 pounds, can you break the bank? Frankly, who cares? Certainly, there is no legitimate way it can be done in real life and just to make doubly sure, the program cheats, or at least does not use casino rules.

Take Black Jack for example. Now if you are a good gambler, this is the game that you stand to make most money at. For every pound that you invest, you should be able to get 99 pence back. The way to win (or not lose as much), is to know when to make favourable bets and when to stick and twist. This can be done because you know that the dealer must twist on 16 and stick on 17.

In this version, the program sticks as soon as it has got a better hand than yours, so all thoughts of tactical betting go out of the window. OK, so you might get lucky in the short term, but the odds over a period of time are totally stacked against you.

Poor graphics and control, especially on the roulette wheel, only heighten the mind-blowing numbness of this game. When will program authors realise that gambling when there is nothing at stake is utterly pointless? Save your money or, if you must blow three quid, put it on the 3.30 at Ascot. At least there'll be some momentary excitement, even if your horse does come in last.

Touchline:
Title: *Las Vegas Casino.* ***Supplier:*** *Zeppelin Games, 28 Osborne Road, Jesmond, Newcastle upon Tyne, NE2 2AJ.* ***Price:*** *£2.99.*



GAMES UPDATE

Para Assault Course

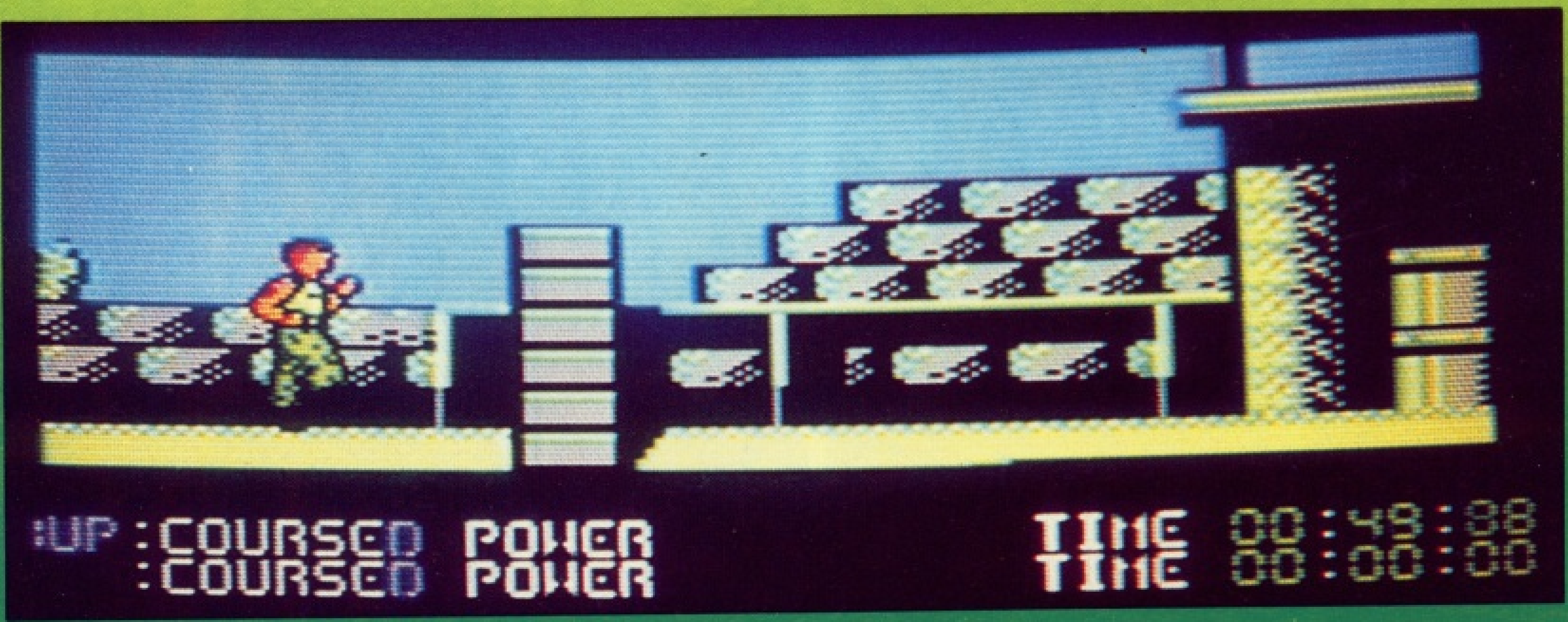
Years ago, I can remember waggling my joystick like mad as I tried to survive a gruelling 1500 metres race in a Decathlon game. Surprise, surprise, the same idea has resurfaced again. Oh to be sure, the game looks superficially different. The backdrop here is a Parachute regiment assault course rather than an athletics stadium, but at the end of the day, joystick waggling is what it is all about.

There are four different courses for you to attempt, each containing a variety of obstacles. There are walls to be climbed, and pools of water to be leapt. There are ramps and rope swings, tunnels and death slides and all the time, you are competing against the clock.

to clear. At a time when the news has just broken about nuclear fusion, there is a new energy force at work here. Run into the wall from a distance of one yard, and bounce back three!

Each course can be previewed and practised before you attempt the real thing, although killing you for falling off the death slide does seem a trifle harsh. Fair enough when you're trying the course proper, but surely not in practice mode.

I didn't enjoy this game at all. Yes, I know it's a version of certain full price games currently available, and this will obviously tempt people to buy it, but it seems to be lacking one vital ingredient – fun. And that after all, is what games are all about.



Clearing an obstacle is very much a case of precise timing, and my feeling was that the limits set by the program were just a little too tight. Too often I was not pixel perfect enough and went crashing into whatever it was I was trying

Touchline:
Title: *Para Assault Course.* ***Supplier:*** *Zeppelin Games, 28 Osborne Road, Jesmond, Newcastle upon Tyne, NE2 2AJ.* ***Price:*** *£2.99.*

Head for Home

We present an update for this popular program

By Kirk McMillan

Head for Home was written using the technique of joining ML Data onto the end of a basic program. A few zero bytes separate each section and prevent the ML from being displayed with Basic's LIST command.

There are two very good reasons for doing this: firstly, it, saves considerable room. Head for Home would not have fitted into the C-16's memory otherwise, and it's faster running, with no waiting for FOR NEXT loops to poke data into memory.

However, there is one disadvantage - Basic programs can't be edited or altered. This changes the number of bytes used, and causes the ML routines to be at a different address to that intended. The only exception is where the change doesn't affect the length of a program - as in changing DLOAD to LOAD. Both commands are tokenised and use one byte.

Unfortunately, Head for Home's machine language wasn't spotted by us at the magazine and was published as two basic program (*YC* March, 1989).

Now comes the task of adding the ML to both programs...

After typing in the basic sections, you must check that no extra spaces or Rems have extended the programs to where the ML is to go. Load the first program in and, in direct mode, enter:

PRINTPEEK (45) +256* PEEK (46)

The answer must be less than 4450. Likewise, the result for the second program should be less than 9528. If not, remove anything from the programs that is not in the listing.

The ML data could be entered directly into the monitor, but there's a lot of typing required with no means of error checking. DATA ENTRY may help a little here by speeding up input and alerting you to errors.

Type in and run the program - it will first ask you for a starting address. Enter the line number from the listing e.g. to begin with it would be 1164. You will need to keep track of where you're up to if you type in the data over several sittings.

When a line is typed in the program will generate a checksum which you can check against the listing. Press RETURN only if it matches - any other key allows you to re-type the line.

To Exit from DATA ENTRY - press ESC twice and then enter the monitor to save your work.

FOR ML1 uses: S "name", 8, 1164, 1404

and ML2: - S"name", 8, 2538, 3630

To continue later on, LOAD "name", 8,1 then NEW, DLOAD "Hex Entry" and RUN. (If using tape substitute "1" for "8" and LOAD for DLOAD.

If you lose track of where you are, or for any reason want to check what has been entered, then simply use the "M" command from within Tedmon. The line addresses and each row of bytes will correspond 1 to 1 with the listing. You could use the "f" command to fill memory with a known value to indicate where data has or hasn't been entered.

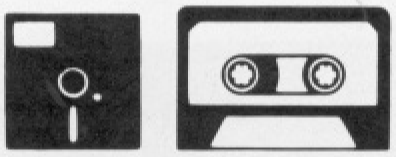
Once both ML sections are finished, (ML1 should be 3 disk blocks, and ML2 18 blocks), the method for merging them with the Basic programs is as follows:

(1) DLOAD "Head for Home" in the normal manner.
(2) RENAME "Head for Home" TO "HFH.old"
(3) LOAD "ml1",8,1
(4) DSAVE "Head for Home"
(5) DLOAD "L. BASIC"
(6) RENAME "1.basic" to "1.basic.old"
(7) LOAD "ml2",8,1
(8) DSAVE "1.basic"

```
HFH DATA ENTRY

10 TRAP160
20 PRINT"[CLS]DATA ENTRY FOR ML1
 OR ML2":PRINT"[DOWN][RIGHT]PRES
S 1 OR 2"
30 GETKEYR$:R=INSTR("12",R$):IFR
=0THEN30
40 IFR=1THENR=5124:ELSER=13872
45 POKE208,(R+10)/256:POKE209,(R
+10)AND255
47 POKE46,PEEK(208):POKE45,PEEK(
209):CLR:R=PEEK(45)+PEEK(46)*256
-10
50 VOL7:INPUT"[DOWN]START ADDRES
S (HEX)";S$
60 S=DEC(S$):PRINT
 70 CH=0:B=S:PRINTHEX$(B)": ";:PO
KE239,0
80 DO:GETKEYC$:PRINTC$;:GETKEYD$
90 PRINTD$" ";:POKEB,DEC(C$+D$):
B=B+1
100 CH=CH+DEC(C$)+DEC(D$)
110 LOOPUNTILB=S+8
120 PRINTCH+S:SOUND1,810,5:POKE2
39,0
130 GETKEYCH$:IFCH$<>CHR$(13)THE
N70
140 SOUND1,917,5:S=S+8:IFS<RTHEN
70
150 PRINT:PRINT"SAVE FILE NOW! R
EFER TEXT IN MAGAZINE."CHR$(9):T
RAP:END
160 PRINT:IFER=14ANDASC(C$)=27TH
EN150:ELSEIFER=14THENSOUND1,50,1
5:RESUME70
170 PRINTERR$(ER)" ERROR LINE"EL
:GOTO150
```

Listings



Head For Home ML 1

```
1164: a0 00 b9 c8 13 99 f7 03   4549
116c: c8 c0 36 d0 f5 a0 00 b9   4564
1174: f4 12 99 10 06 c8 c0 d1   4561
117c: d0 f5 a2 00 bd 95 11 9d   4583
1184: f5 0c e8 d0 f7 bd 95 12   4614
118c: f0 06 9d f5 0d e8 10 f5   4611
1194: 60 a0 20 20 20 20 20 20   4528
119c: a0 20 20 20 20 a0 20 20   4540
11a4: a0 a0 a0 a0 20 20 20 20   4564
11ac: 20 a0 a0 a0 a0 20 20 20   4572
11b4: 20 20 20 20 20 20 20 20   4548
11bc: 20 a0 20 20 20 20 20 20   4564
11c4: a0 20 20 20 20 a0 20 20   4580
11cc: a0 20 20 20 a0 20 20 20   4588
11d4: a0 20 20 20 20 a0 20 20   4596
11dc: 20 20 20 20 20 20 20 20   4588
11e4: 20 a0 20 20 20 20 20 20   4604
11ec: a0 20 20 20 20 a0 20 20   4620
11f4: a0 20 20 20 20 a0 20 20   4628
11fc: a0 20 20 20 20 a0 20 20   4636
1204: 20 20 20 20 20 20 20 20   4628
120c: 20 a0 20 20 20 20 20 20   4644
1214: a0 20 20 20 20 a0 20 20   4660
121c: a0 20 20 20 20 a0 20 20   4668
1224: a0 20 20 20 20 a0 20 20   4676
122c: 20 20 20 20 20 20 20 20   4668
1234: 20 a0 20 20 20 20 20 20   4684
123c: a0 20 20 20 20 a0 20 20   4700
1244: a0 20 20 20 20 a0 20 20   4708
124c: a0 20 20 20 20 a0 20 20   4716
1254: 20 20 20 20 20 20 20 20   4708
125c: 20 a0 20 20 20 20 20 20   4724
1264: a0 20 20 20 20 a0 20 20   4740
126c: a0 20 20 20 20 a0 20 20   4748
1274: a0 20 20 20 20 a0 20 20   4756
127c: 20 20 20 20 20 20 20 20   4748
1284: 20 a0 20 20 20 20 20 20   4764
128c: a0 20 20 20 20 a0 20 20   4780
1294: a0 20 20 20 20 a0 20 20   4788
129c: a0 20 20 20 20 a0 20 20   4796
12a4: 20 20 20 20 20 20 20 20   4788
12ac: 20 a0 20 20 20 20 20 20   4804
12b4: a0 20 20 20 20 a0 20 20   4820
12bc: a0 20 20 20 a0 20 20 20   4828
12c4: a0 20 20 20 20 a0 20 20   4836
12cc: 20 20 20 20 20 20 20 20   4828
12d4: 20 a0 a0 a0 a0 a0 20 20   4876
12dc: 20 a0 a0 a0 a0 20 20 20   4876
12e4: a0 a0 a0 a0 20 20 20 20   4884
12ec: 20 a0 a0 a0 a0 20 00 00   4888
12f4: a2 00 a9 a0 9d 39 0c e8   4961
12fc: e0 06 d0 f8 a2 00 9d b1   4962
1304: 0c e8 e0 06 d0 f8 8d 61   4986
130c: 0c 8d 89 0c 4c 47 06 ea   4995
1314: ea a9 cb 8d 12 ff a9 34   5030
131c: 8d 13 ff 60 a9 d0 8d 13   5010
1324: ff a9 c4 8d 12 ff 60 8d   5046
132c: 66 0c 8d 8e 0c a2 e2 8e   5037
1334: 62 0c e8 8e 8a 0c e8 8e   5054
133c: 63 0c e8 8e 64 0c e8 8e   5055
1344: 8c 0c e8 8e 65 0c e8 8e   5075
134c: 8b 0c 8e 8d 0c 60 a2 00   5044
1354: a9 63 9d 39 08 e8 e0 7e   5075
135c: d0 f8 a2 00 a9 71 9d 62   5061
1364: 08 e8 e0 04 d0 f8 a2 00   5060
136c: 9d 8a 08 e8 e0 04 d0 f8   5096
1374: 60 a2 00 a9 77 9d 39 08   5073
137c: e8 e0 7e d0 f8 a2 00 a9   5112
1384: 00 9d 62 08 e8 e0 04 d0   5087
138c: f8 a2 00 9d 8a 08 e8 e0   5123
1394: 04 d0 f8 60 a2 00 bd 00   5094
139c: 38 9d 00 08 e8 d0 f7 a9   5137
13a4: 0f cd bb 06 f0 08 ee b8   5166
13ac: 06 ee bb 06 10 e6 a9 38   5149
13b4: 8d b8 06 a9 08 8d bb 06   5166
13bc: 60 00 00 00 00 00 00 00   5058
13c4: 00 00 00 00 a0 00 b9 40   5094
13cc: 35 99 00 3f c8 c0 e9 d0   5180
13d4: f5 a0 00 b9 40 34 99 00   5155
13dc: 3e c8 d0 f7 ce 08 04 ce   5220
13e4: 0b 04 ad 0b 04 c9 2e d0   5195
13ec: ea a9 29 85 2d a9 25 85   5221
13f4: 2e a9 00 85 37 a9 2f 85   5215
13fc: 38 60 00 00 00 00 00 00   5133
```

Head For Home ML 2

```
2538: 00 00 00 00 00 00 00 00   9528
2540: 04 16 04 14 04 12 04 10   9568
2548: 04 0e 04 0c 04 0a 04 08   9604
2550: 04 06 04 04 04 02 04 00   9580
2558: 06 00 08 00 0a 00 0c 00   9596
2560: 0e 00 10 00 12 00 14 00   9591
2568: 16 00 18 00 1a 00 1a 02   9616
2570: 1a 04 1a 06 1a 08 1a 0a   9656
2578: 1a 0c 1a 0e 1a 10 1a 12   9666
2580: 1a 14 1a 16 18 16 16 16   9664
2588: 14 16 12 16 10 16 0e 16   9659
2590: 0c 16 0a 16 08 16 06 16   9680
2598: 04 16 04 14 04 12 04 10   9656
25a0: 04 0e 04 0c 04 0a 04 08   9692
25a8: 04 06 04 04 04 02 04 00   9668
25b0: 06 00 08 00 0a 00 0c 00   9684
25b8: 0e 00 10 00 12 00 14 00   9679
25c0: 16 00 18 00 1a 00 1a 02   9704
25c8: 1a 04 1a 06 1a 08 1a 0a   9744
25d0: 1a 0c 0e 14 0e 12 0e 10   9754
25d8: 0e 0e 06 0a 08 0a 0a 0a   9770
25e0: 0c 0a 10 02 10 04 10 06   9733
25e8: 10 08 18 0c 16 0c 14 0c   9770
25f0: 12 0c ff a2 00 4c de 33   9818
25f8: 00 14 02 14 00 16 02 16   9748
2600: 00 00 02 00 00 02 02 02   9736
2608: 1c 00 1e 00 1c 02 1e 02   9796
2610: 1c 14 1e 14 1c 16 1e 16   9824
2618: 08 0f 0a 0f 08 11 0a 11   9822
2620: 08 05 0a 05 08 07 0a 07   9820
2628: 14 05 16 05 14 07 16 07   9816
2630: 14 0f 16 0f 14 11 16 11   9834
2638: 88 20 cd 33 4c 92 33 00   9866
2640: 01 0c 0c 20 14 08 05 20   9839
2648: 14 12 01 04 09 14 09 0f   9851
2650: 0e 01 0c 20 12 15 0c 05   9863
2658: 13 20 01 10 10 0c 19 20   9849
2660: 01 20 13 09 18 20 09 13   9864
2668: 20 0e 05 05 04 05 04 20   9873
2670: 14 0f 20 0c 05 01 16 05   9892
2678: 20 08 0f 0d 05 20 02 01   9896
2680: 13 05 20 01 0e 04 20 20   9890
2688: 19 0f 15 20 12 01 03 05   9909
2690: 20 01 12 0f 15 0e 04 20   9919
2698: 14 08 05 20 02 0f 01 12   9921
26a0: 04 2c 20 13 05 0e 04 09   9944
26a8: 0e 07 20 20 20 20 20 20   9929
26b0: 19 0f 15 12 20 0f 10 10   9957
26b8: 0f 0e 05 0e 14 13 20 0d   9984
26c0: 05 0e 20 02 01 03 0b 20   9960
26c8: 08 0f 0d 05 20 09 06 20   9988
26d0: 19 0f 15 20 20 20 20 20   9977
26d8: 0c 01 0e 04 20 0f 0e 20   10008
26e0: 14 08 05 0d 20 20 20 20   9991
26e8: 14 08 05 20 06 09 12 13   10002
26f0: 14 20 10 0c 01 19 05 12   10007
26f8: 20 14 0f 20 12 05 01 03   10012
2700: 08 20 14 08 05 20 05 0e   10033
2708: 04 20 17 09 14 08 20 20   10032
2710: 01 0c 0c 20 34 20 0d 05   10054
2718: 0e 20 09 13 20 14 08 05   10057
2720: 20 17 09 0e 0e 05 12 2c   10085
2728: 20 01 0c 14 08 0f 15 07   10080
2730: 08 20 14 08 05 20 20 20   10066
2738: 07 01 0d 05 20 03 0f 0e   10100
2740: 14 09 0e 15 05 13 20 15   10099
2748: 0e 14 09 0c 20 01 0c 0c   10123
2750: 20 10 0c 01 19 05 12 13   10102
2758: 20 01 12 05 20 20 20 20   10091
2760: 06 09 0e 09 13 08 05 04   10139
2768: 19 0f 15 20 03 01 0e 0e   10153
2770: 0f 14 20 27 04 0f 15 02   10154
2778: 0c 05 2d 15 10 27 20 17   10162
2780: 09 14 08 20 19 0f 15 12   10170
2788: 20 0d 05 0e 20 20 20 20   10162
2790: 01 0e 04 20 09 06 20 32   10171
2798: 20 10 09 05 03 05 13 20   10167
27a0: 0f 03 03 15 10 19 20 14   10189
27a8: 08 05 20 13 01 0d 05 20   10192
27b0: 13 11 15 01 12 05 20 20   10185
27b8: 19 0f 15 20 0d 15 13 14   10229
27c0: 20 0d 0f 16 05 20 14 08   10233
27c8: 05 20 14 0f 10 20 0f 0e   10243
27d0: 05 20 06 09 12 13 14 20   10228
27d8: 20 20 20 20 20 20 20 20   10216
27e0: 0f 0e 03 05 20 0c 05 01   10265
27e8: 16 09 0e 07 20 14 08 05   10273
27f0: 20 14 12 01 03 0b 2c 20   10265
27f8: 19 0f 15 20 0d 15 13 14   10293
2800: 20 14 08 12 0f 17 20 20   10285
2808: 14 08 05 20 05 18 01 03   10286
2810: 14 20 0e 15 0d 02 05 12   10306
2818: 20 14 0f 20 06 09 0e 09   10326
2820: 13 08 a2 00 bd 00 30 9d   10345
2828: f1 0c e8 e0 20 d0 f5 a2   10391
2830: 00 bd 20 30 9d 41 0d e8   10379
2838: e0 84 d0 f5 a2 00 bd a8   10409
2840: 30 9d 09 0e e8 e0 80 d0   10409
2848: f5 a2 00 bd 28 31 9d d1   10418
2850: 0e e8 e0 ba d0 f5 60 00   10430
2858: 54 02 2a 03 07 83 02 c0   10386
2860: 02 0e ad 02 e3 02 07 c0   10415
2868: 02 02 03 15 ad 02 e3 02   10401
2870: 15 83 02 c0 02 15 54 02   10402
2878: e3 02 15 04 02 02 03 0e   10410
2880: c5 01 e3 02 07 7f 01 c0   10447
2888: 02 23 54 02 2a 03 07 83   10427
2890: 02 c0 02 0e ad 02 e3 02   10458
2898: 07 c0 02 02 03 15 ad 02   10449
28a0: e3 02 15 83 02 c0 02 15   10458
28a8: c0 02 02 03 15 ad 02 e3   10475
28b0: 02 32 fd 03 fd 03 03 ad   10511
28b8: 02 e3 02 07 c0 02 02 03   10471
28c0: 0e d1 02 10 03 07 e3 02   10492
28c8: 1e 03 15 c0 02 02 03 15   10489
28d0: ad 02 df 02 15 83 02 c0   10534
28d8: 02 15 1f 02 6c 02 0e 04   10520
28e0: 02 83 02 07 c5 01 ad 02   10529
28e8: 23 fd 03 fd 03 03 c5 01   10560
28f0: ad 02 07 04 02 c0 02 0e   10546
28f8: 1f 02 6c 02 07 54 02 ad   10567
2900: 02 15 fd 03 fd 03 03 54   10578
2908: 02 ad 02 15 83 02 c0 02   10564
2910: 15 54 02 b7 02 15 04 02   10561
2918: c0 02 37 54 02 2a 03 07   10577
2920: 83 02 c0 02 0e ad 02 e3   10611
2928: 02 07 c0 02 02 03 15 ad   10593
2930: 02 e3 02 15 83 02 c0 02   10598
2938: 15 54 02 e3 02 15 04 02   10600
2940: 02 03 0e c5 01 e3 02 07   10623
2948: 7f 01 c0 02 37 54 02 8f   10649
2950: 02 07 c0 02 02 03 15 fd   10638
2958: 03 fd 03 03 c0 02 02 03   10640
2960: 15 e3 02 ad 02 15 c0 02   10662
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2968: 02 03 15 83 02 c0 02 50   10643
2970: 54 02 ad 02 07 83 02 c0   10676
2978: 02 15 ad 02 e3 02 15 c0   10686
2980: 02 02 03 0e ad 02 e3 02   10689
2988: 15 83 02 c0 02 07 54 02   10683
2990: ad 02 15 04 02 c0 02 15   10697
2998: 54 02 ad 02 23 04 02 c0   10707
29a0: 02 07 54 02 ad 02 0e 83   10726
29a8: 02 c0 02 07 ad 02 e3 02   10731
29b0: 0e c0 02 02 03 07 e3 02   10731
29b8: ad 02 15 54 02 ad 02 15   10753
29c0: c0 02 60 03 15 54 02 59   10742
29c8: 01 15 7f 01 04 02 23 00   10737
29d0: a0 00 a9 6b 91 03 a9 ae   10806
29d8: 91 05 98 48 20 e4 ff c9   10827
29e0: 00 f0 f9 c9 0d f0 20 c9   10831
29e8: 14 f0 27 c9 41 30 ed c9   10834
29f0: 90 10 e9 aa 68 a8 c0 06   10839
29f8: f0 13 8a 38 e9 40 91 03   10832
2a00: a9 2e 91 05 c8 10 cb 68   10860
2a08: a8 c0 00 f0 ce a9 20 91   10862
2a10: 03 60 68 a8 c0 00 f0 c3   10851
2a18: 20 cd 33 4c f8 2f 18 b5   10890
2a20: d0 a8 65 d4 c5 d4 f0 0c   10904
2a28: c9 2e 10 08 c0 29 30 0a   10874
2a30: c9 2d f0 06 e8 e0 04 d0   10910
2a38: e5 60 a9 00 85 03 60 00   10874
2a40: 3c 66 6e 6e 60 62 3c 00   10912
2a48: 18 3c 66 7e 66 66 66 00   10917
2a50: 7c 66 66 7c 66 66 7c 00   10937
2a58: 3c 66 60 60 60 66 3c 00   10912
2a60: 78 6c 66 66 66 6c 78 00   10950
2a68: 7e 60 60 78 60 60 7e 00   10937
2a70: 7e 60 60 78 60 60 60 00   10930
2a78: 3c 66 60 6e 66 66 3c 00   10964
2a80: 66 66 66 7e 66 66 66 00   10973
2a88: 3c 18 18 18 18 18 3c 00   10963
2a90: 1e 0c 0c 0c 0c 6c 38 00   10988
2a98: 66 6c 78 70 78 6c 66 00   11001
2aa0: 60 60 60 60 60 60 7e 00   10969
2aa8: 63 77 7f 6b 63 63 63 00   11009
2ab0: 66 76 7e 7e 6e 66 66 00   11039
2ab8: 3c 66 66 66 66 66 3c 00   11026
2ac0: 7c 66 66 7c 60 60 60 00   11024
2ac8: 3c 66 66 66 66 3c 0e 00   11044
2ad0: 7c 66 66 7c 78 6c 66 00   11067
2ad8: 3c 66 60 3c 06 66 3c 00   11049
2ae0: 7e 18 18 18 18 18 18 00   11051
2ae8: 66 66 66 66 66 66 3c 00   11071
2af0: 66 66 66 66 66 3c 18 00   11076
2af8: 63 63 63 6b 7f 77 63 00   11089
2b00: 66 66 3c 18 3c 66 66 00   11095
2b08: 66 66 66 3c 18 18 18 00   11094
2b10: 7e 06 0c 18 30 60 7e 00   11102
2b18: 3c 30 30 30 30 30 3c 00   11077
2b20: 0c 12 30 7c 30 62 fc 00   11115
2b28: 3c 0c 0c 0c 0c 0c 3c 00   11138
2b30: 00 18 3c 7e 18 18 18 18   11137
2b38: 00 10 30 7f 7f 30 10 00   11116
2b40: 00 00 00 00 00 00 00 00   11072
2b48: 18 18 18 18 00 00 18 00   11125
2b50: 66 66 66 00 00 00 00 00   11124
2b58: 66 66 ff 66 ff 66 66 00   11216
2b60: 18 3e 60 3c 06 7c 18 00   11185
2b68: 62 66 0c 18 30 66 46 00   11178
2b70: 3c 66 3c 38 67 66 3f 00   11216
2b78: 06 0c 18 00 00 00 00 00   11155
2b80: 0c 18 30 30 30 18 0c 00   11187
2b88: 30 18 0c 0c 0c 18 30 00   11204
2b90: 00 66 3c ff 3c 66 00 00   11236
2b98: 00 18 18 7e 18 18 00 00   11217
2ba0: 00 00 00 00 00 18 18 30   11189
2ba8: 00 00 00 7e 00 00 00 00   11197
2bb0: 00 00 00 00 00 18 18 00   11202
2bb8: 00 03 06 0c 18 30 60 00   11231
2bc0: 3c 66 6e 76 66 66 3c 00   11299
2bc8: 18 18 38 18 18 18 7e 00   11285
2bd0: 3c 66 06 0c 30 60 7e 00   11291
2bd8: 3c 66 06 1c 06 66 3c 00   11303
2be0: 06 0e 1e 66 7f 06 06 00   11313
2be8: 7e 60 7c 06 06 66 3c 00   11325
2bf0: 3c 66 60 7c 66 66 3c 00   11339
2bf8: 7e 66 0c 18 18 18 18 00   11337
2c00: 3c 66 66 3c 66 66 3c 00   11357
2c08: 3c 66 66 3e 06 66 3c 00   11361
2c10: 00 00 18 00 00 18 00 00   11298
2c18: 00 00 18 00 00 18 18 30   11318
2c20: 0e 18 30 60 30 18 0e 00   11354
2c28: 00 00 7e 00 7e 00 00 00   11346
2c30: 70 18 0c 06 0c 18 70 00   11374
2c38: 3c 66 06 0c 18 00 18 00   11383
2c40: 01 01 01 01 01 01 01 ff   11365
2c48: 00 fe fe fe 3e 3e 3e 3e   11491
2c50: 3e 3e 3e fe fe fe fe 00   11511
2c58: 00 7f 7f 7f 78 7f 7f 78   11492
2c60: 00 fe fe fe 1e 9e 9e 1e   11523
2c68: 79 79 78 7f 7f 7f 7f 00   11503
2c70: fe fe 1e fe fe fe fe 00   11565
2c78: 7f 7f 78 7f 7f 7f 7f 00   11531
2c80: 9e 9e 1e fe fe fe fe 00   11569
2c88: 00 00 00 e0 f0 38 18 18   11458
2c90: 18 18 1c 0f 07 00 00 00   11461
2c98: 18 18 38 f0 e0 00 00 00   11474
2ca0: c0 c0 c0 c0 c0 c0 ff ff   11556
2ca8: c0 e0 70 38 1c 0e 07 03   11513
2cb0: 03 07 0e 1c 38 70 e0 c0   11521
2cb8: ff ff c0 c0 c0 c0 c0 c0   11580
2cc0: ff ff 03 03 03 03 03 03   11534
2cc8: 00 3c 7e 7e 7e 7e 3c 00   11578
2cd0: 00 00 00 00 00 ff ff 00   11532
2cd8: 36 7f 7f 7f 3e 1c 08 00   11593
2ce0: 60 60 60 60 60 60 60 60   11536
2ce8: 00 00 00 07 0f 1c 18 18   11549
2cf0: c3 e7 7e 3c 3c 7e e7 c3   11648
2cf8: 00 3c 7e 66 66 7e 3c 00   11608
2d00: 18 18 66 66 18 18 3c 00   11595
2d08: 06 06 06 06 06 06 06 06   11576
2d10: 08 1c 3e 7f 3e 1c 08 00   11634
2d18: 18 18 18 ff ff 18 18 18   11658
2d20: c0 c0 30 30 c0 c0 30 30   11612
2d28: 18 18 18 18 18 18 18 18   11632
2d30: 00 00 03 3e 76 36 36 00   11619
2d38: ff 7f 3f 1f 0f 07 03 01   11688
2d40: 00 00 00 00 00 00 00 00   11584
2d48: 99 ff 99 ff 99 ff 99 ff   11784
2d50: 00 00 00 60 60 60 60 60   11630
2d58: 60 60 60 60 7e 00 00 00   11653
2d60: 00 00 00 66 66 66 66 66   11676
2d68: 00 00 00 78 6c 66 66 66   11693
2d70: 66 66 66 6c 78 00 00 00   11701
2d78: 00 00 00 3c 66 66 66 66   11703
2d80: 66 66 66 66 3c 00 00 00   11711
2d88: ff 01 01 99 b1 e1 c1 f9   11770
2d90: f9 c1 e1 b1 99 01 01 ff   11778
2d98: ff ff ff ff ff ff ff ff   11912
2da0: 80 80 80 80 80 80 80 ff   11766
2da8: ff 99 ff 99 ff 99 ff 99   11880
2db0: ff 80 80 99 8d 87 83 9f   11831
2db8: ff 80 80 80 80 80 80 80   11790
2dc0: ff 01 01 01 01 01 01 01   11749
2dc8: 9f 83 87 8d 99 80 80 ff   11855
2dd0: 00 7f 7f 7f 79 79 79 78   11857
2dd8: 00 fe fe fe fe 3e 3e 1e   11901
2de0: 3e 3e 3e fe fe fe fe 00   11911
2de8: e0 e0 e0 e0 e0 e0 e0 e0   11864
2df0: 07 07 07 07 07 07 07 07   11816
2df8: ff ff 00 00 00 00 00 00   11828
2e00: ff ff ff 00 00 00 00 00   11866
2e08: 00 00 00 00 00 ff ff ff   11874
2e10: 03 03 03 03 03 03 ff ff   11870
2e18: 00 00 00 00 f0 f0 f0 f0   11860
2e20: 0f 0f 0f 0f 00 00 00 00   11868
2e28: 18 18 18 f8 f8 00 00 00   11889
2e30: f0 f0 f0 f0 00 00 00 00   11884
2e38: f0 f0 f0 f0 0f 0f 0f 0f   11952
2e40: 32 32 32 32 32 32 00 00   11870
2e48: 00 00 00 00 00 00 00 00   11848
2e50: 00 00 00 00 00 00 00 00   11856
2e58: 00 00 44 44 44 44 44 44   11912
2e60: 00 00 00 00 00 00 00 00   11872
2e68: 32 32 32 32 32 32 00 00   11910
2e70: 00 00 00 00 00 00 00 00   11888
2e78: 00 00 00 00 00 00 00 00   11896
2e80: 00 00 44 44 44 44 44 44   11952
2e88: 00 77 77 77 77 77 77 00   11996
2e90: 32 32 32 32 00 00 32 32   11950
2e98: 32 32 32 32 32 32 32 32   11968
2ea0: 44 44 44 44 44 44 44 44   12000
2ea8: 44 44 00 00 44 44 44 44   11992
2eb0: 00 77 00 00 00 00 77 00   11980
2eb8: 32 32 32 32 00 00 32 32   11990
2ec0: 32 32 32 32 32 32 32 32   12008
2ec8: 44 44 44 44 44 44 44 44   12040
2ed0: 44 44 00 00 44 44 44 44   12032
2ed8: 00 77 00 00 00 00 77 00   12020
2ee0: 68 68 68 68 00 00 32 32   12066
2ee8: 32 32 32 32 32 32 32 32   12048
2ef0: 44 44 44 44 44 44 44 44   12080
2ef8: 44 44 00 00 68 68 68 68   12096
2f00: 00 77 77 77 77 77 77 00   12116
2f08: 68 68 68 68 00 00 32 32   12106
2f10: 32 32 32 32 32 32 32 32   12088
2f18: 44 44 44 44 44 44 44 44   12120
2f20: 44 44 00 00 68 68 68 68   12136
2f28: 00 00 00 00 00 00 00 00   12072
2f30: 68 68 68 68 00 00 32 32   12146
2f38: 32 32 32 32 32 32 32 32   12128
2f40: 44 44 44 44 44 44 44 44   12160
2f48: 44 44 00 00 68 68 68 68   12176
2f50: 00 00 00 00 00 00 00 00   12112
2f58: 68 68 68 68 00 00 32 32   12186
2f60: 32 32 32 32 32 32 32 32   12168
2f68: 44 44 44 44 44 44 44 44   12200
2f70: 44 44 00 00 68 68 68 68   12216
2f78: 00 00 00 00 00 00 00 00   12152
2f80: 68 68 68 68 00 00 32 32   12226
2f88: 32 32 32 32 32 32 32 32   12208
2f90: 44 44 44 44 44 44 44 44   12240
2f98: 44 44 00 00 68 68 68 68   12256
2fa0: 00 00 00 00 00 00 00 00   12192
2fa8: 68 68 68 68 00 00 32 32   12266
2fb0: 32 32 32 32 32 32 32 32   12248
2fb8: 44 44 44 44 44 44 44 44   12280
2fc0: 44 44 00 00 68 68 68 68   12296
2fc8: 00 00 00 00 00 00 00 00   12232
2fd0: 68 68 68 68 00 00 32 32   12306
2fd8: 32 32 32 32 32 32 32 32   12288
2fe0: 44 44 44 44 44 44 44 44   12320
2fe8: 44 44 00 00 68 68 68 68   12336
2ff0: 00 00 00 00 00 00 00 00   12272
2ff8: 68 68 68 68 00 00 32 32   12346
3000: 32 32 32 32 32 32 32 32   12328
3008: 44 44 44 44 44 44 44 44   12360
```

Head For Home ML 2b

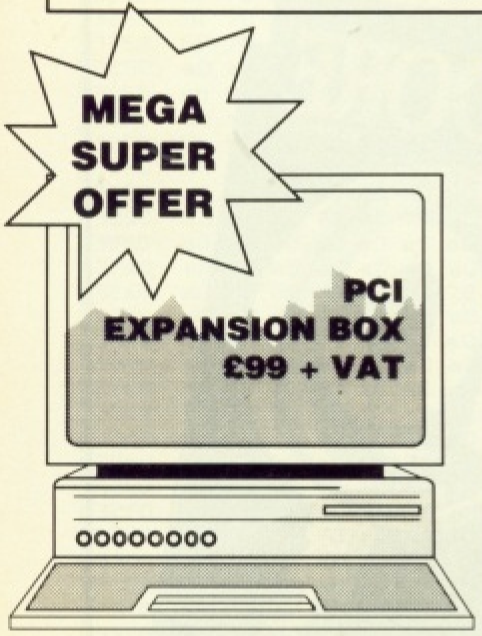
```
3010: 44 44 00 00 68 68 68 68   12376
3018: 00 00 00 00 00 00 00 00   12312
3020: 68 68 68 68 00 00 35 35   12392
3028: 35 35 35 35 35 35 35 35   12392
3030: 2e 2e 2e 2e 2e 2e 2e 2e   12464
3038: 2e 2e 00 00 68 68 68 68   12432
3040: 00 00 00 00 00 00 00 00   12352
3048: 68 68 68 68 00 00 35 35   12432
3050: 35 35 35 35 35 35 35 35   12432
3058: 2e 2e 2e 2e 2e 2e 2e 2e   12504
3060: 2e 2e 00 00 68 68 68 68   12472
3068: 00 00 00 00 00 00 00 00   12392
3070: 68 68 68 68 00 00 35 35   12472
3078: 35 35 35 35 35 35 35 35   12472
3080: 2e 2e 2e 2e 2e 2e 2e 2e   12544
3088: 2e 2e 00 00 68 68 68 68   12512
3090: 00 00 00 00 00 00 00 00   12432
3098: 68 68 68 68 00 00 35 35   12512
30a0: 35 35 35 35 35 35 35 35   12512
30a8: 2e 2e 2e 2e 2e 2e 2e 2e   12584
30b0: 2e 2e 00 00 68 68 68 68   12552
30b8: 00 00 00 00 00 00 00 00   12472
30c0: 68 68 68 68 00 00 35 35   12552
30c8: 35 35 35 35 35 35 35 35   12552
30d0: 2e 2e 2e 2e 2e 2e 2e 2e   12624
30d8: 2e 2e 00 00 68 68 68 68   12592
30e0: 00 00 00 00 00 00 00 00   12512
30e8: 68 68 68 68 00 00 35 35   12592
30f0: 35 35 35 35 35 35 35 35   12592
30f8: 2e 2e 2e 2e 2e 2e 2e 2e   12664
3100: 2e 2e 00 00 68 68 68 68   12632
3108: 00 00 00 00 00 00 00 00   12552
3110: 68 68 68 68 00 00 35 35   12632
3118: 35 35 35 35 35 35 35 35   12632
3120: 2e 2e 2e 2e 2e 2e 2e 2e   12704
3128: 2e 2e 00 00 68 68 68 68   12672
3130: 00 00 00 00 00 00 00 00   12592
3138: 68 68 68 68 00 00 35 35   12672
3140: 35 35 35 35 35 35 35 35   12672
3148: 2e 2e 2e 2e 2e 2e 2e 2e   12744
3150: 2e 2e 00 00 68 68 68 68   12712
3158: 00 00 00 00 00 00 00 00   12632
3160: 35 35 35 35 00 00 35 35   12688
3168: 35 35 35 35 35 35 35 35   12712
3170: 2e 2e 2e 2e 2e 2e 2e 2e   12784
3178: 2e 2e 00 00 2e 2e 2e 2e   12760
3180: 00 00 00 00 00 00 00 00   12672
3188: 35 35 35 35 00 00 35 35   12728
3190: 35 35 35 35 35 35 35 35   12752
3198: 2e 2e 2e 2e 2e 2e 2e 2e   12824
31a0: 2e 2e 00 00 2e 2e 2e 2e   12800
31a8: 00 00 00 00 00 00 00 00   12712
31b0: 35 35 35 35 35 35 00 00   12768
31b8: 00 00 00 00 00 00 00 00   12728
31c0: 00 00 00 00 00 00 00 00   12736
31c8: 00 00 2e 2e 2e 2e 2e 2e   12840
31d0: 00 00 00 00 00 00 00 00   12752
31d8: 35 35 35 35 35 35 00 00   12808
31e0: 00 00 00 00 00 00 00 00   12768
31e8: 00 00 00 00 00 00 00 00   12776
```

```
31f0: 00 00 2e 2e 2e 2e 2e 2e  12880
31f8: 00 00 00 00 00 00 00 00  12792
3200: 68 68 68 68 68 68 68 68  12912
3208: 68 68 68 68 68 68 68 68  12920
3210: 68 68 68 68 68 68 68 68  12928
3218: 68 68 68 68 68 68 68 68  12936
3220: 68 68 68 68 68 68 68 68  12944
3228: 00 00 00 00 00 00 00 00  12840
3230: 00 00 00 00 00 00 00 00  12848
3238: 00 00 00 00 00 00 00 00  12856
3240: ef 41 43 44 6d 6d 6f 70  12979
3248: 6f 70 6f 70 6f 70 6f 70  12984
3250: 6f 70 6f 70 6f 70 6f 70  12992
3258: 6f 70 6d 6d ef 41 43 44  13003
3260: a0 a0 a0 a0 a0 a0 a0 a0  12976
3268: ec 42 45 46 6d 6d 6c 40  13015
3270: 6c 40 6c 40 6c 40 6c 40  13000
3278: 6c 40 6c 40 6c 40 6c 40  13008
3280: 6c 40 6d 6d ec 42 45 46  13039
3288: a0 a0 a0 a0 a0 a0 a0 a0  13016
3290: 43 44 72 73 6f 70 a0 a0  13026
3298: a0 a0 a0 a0 a0 a0 a0 a0  13032
32a0: ef f0 a0 a0 a0 a0 a0 a0  13064
32a8: a0 a0 6f 70 43 44 72 73  13050
32b0: a0 a0 e2 e4 e5 e7 a0 a0  13090
32b8: 47 48 ec 74 6c 40 a0 a0  13086
32c0: a0 a0 a0 a0 a0 a0 a0 a0  13072
32c8: ec c0 a0 a0 a0 a0 a0 a0  13098
32d0: a0 a0 6c 40 47 48 ec 74  13110
32d8: a0 a0 e3 e8 e6 e8 a0 a0  13137
32e0: a0 a0 a0 a0 6f 70 a0 a0  13112
32e8: a0 a0 a0 a0 a0 a0 a0 a0  13112
32f0: ef f0 a0 a0 a0 a0 a0 a0  13144
32f8: a0 a0 6f 70 a0 a0 a0 a0  13136
3300: a0 a0 a0 a0 a0 a0 a0 a0  13136
3308: a0 a0 a0 a0 6c 40 a0 a0  13146
3310: a0 a0 a0 a0 a0 a0 a0 a0  13152
3318: ec c0 a0 a0 a0 a0 a0 a0  13178
3320: a0 a0 6c 40 a0 a0 a0 a0  13170
3328: a0 a0 a0 a0 a0 a0 a0 a0  13176
3330: a0 a0 a0 a0 6f 70 a0 a0  13192
3338: a0 a0 a0 a0 a0 a0 a0 a0  13192
3340: ef f0 a0 a0 a0 a0 a0 a0  13224
3348: a0 a0 6f 70 a0 a0 a0 a0  13216
3350: a0 a0 a0 a0 a0 a0 a0 a0  13216
3358: a0 a0 a0 a0 6c 40 a0 a0  13226
3360: a0 a0 a0 a0 a0 a0 a0 a0  13232
3368: ec c0 a0 a0 a0 a0 a0 a0  13258
3370: a0 a0 6c 40 a0 a0 a0 a0  13250
3378: a0 a0 a0 a0 a0 a0 a0 a0  13256
3380: a0 a0 a0 a0 6f 70 a0 a0  13272
3388: a0 a0 a0 a0 a0 a0 a0 a0  13272
3390: ef f0 a0 a0 a0 a0 a0 a0  13304
3398: a0 a0 6f 70 a0 a0 a0 a0  13296
33a0: a0 a0 a0 a0 a0 a0 a0 a0  13296
33a8: a0 a0 a0 a0 6c 40 a0 a0  13306
33b0: a0 a0 a0 a0 a0 a0 a0 a0  13312
33b8: ec c0 a0 a0 a0 a0 a0 a0  13338
33c0: a0 a0 6c 40 a0 a0 a0 a0  13330
33c8: a0 a0 a0 a0 a0 a0 a0 a0  13336
33d0: a0 a0 a0 a0 6f 70 ef f0  13376
33d8: ef f0 ef f0 ef f0 ee e9  13455
33e0: ee e9 a0 a0 a0 a0 a0 a0  13391
33e8: a0 a0 6f 70 a0 a0 a0 a0  13376
33f0: a0 a0 a0 a0 a0 a0 a0 a0  13376
33f8: a0 a0 a0 a0 6c 40 ec c0  13404
3400: ec c0 ec c0 ec c0 f1 ea  13466
3408: f1 ea a0 a0 a0 a0 a0 a0  13420
3410: a0 a0 6c 40 a0 a0 a0 a0  13410
3418: a0 a0 a0 a0 a0 a0 a0 a0  13416
3420: a0 a0 a0 a0 6f 70 a0 a0  13432
3428: a0 a0 a0 a0 a0 a0 ee e9  13463
3430: ee e9 ef f0 ef f0 ef f0  13543
3438: ef f0 6f 70 a0 a0 a0 a0  13480
3440: a0 90 89 85 83 85 a0 a0  13469
3448: a0 a0 a0 a0 6c 40 a0 a0  13466
3450: a0 a0 a0 a0 a0 a0 f1 ea  13492
3458: f1 ea ec c0 ec c0 ec c0  13554
3460: ec c0 6c 40 a0 a0 a0 a0  13508
3468: a0 a0 a0 a0 a0 a0 a0 a0  13496
3470: a0 a0 a0 a0 6f 70 a0 a0  13512
3478: a0 a0 a0 a0 a0 a0 ef f0  13536
3480: a0 a0 a0 a0 a0 a0 a0 a0  13520
3488: a0 a0 6f 70 a0 a0 a0 a0  13536
3490: a0 a0 a0 a0 a0 a0 a0 a0  13536
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34a0: a0 a0 a0 a0 a0 a0 ec c0  13570
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34b0: a0 a0 6c 40 a0 a0 a0 a0  13570
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34c0: a0 a0 a0 a0 6f 70 a0 a0  13592
34c8: a0 a0 a0 a0 a0 a0 ef f0  13616
34d0: a0 a0 a0 a0 a0 a0 a0 a0  13600
34d8: a0 a0 6f 70 a0 a0 a0 a0  13616
34e0: a0 55 78 78 78 49 a0 a0  13634
34e8: a0 a0 a0 a0 6c 40 a0 a0  13626
34f0: a0 a0 a0 a0 a0 a0 ec c0  13650
34f8: a0 a0 a0 a0 a0 a0 a0 a0  13640
3500: a0 a0 6c 40 a0 a0 a0 a0  13650
3508: a0 75 20 60 20 76 a0 a0  13641
3510: a0 a0 a0 a0 6f 70 a0 a0  13672
3518: a0 a0 a0 a0 a0 a0 ef f0  13696
3520: a0 a0 a0 a0 a0 a0 a0 a0  13680
3528: a0 a0 6f 70 a0 a0 a0 a0  13696
3530: a0 75 60 60 60 76 a0 a0  13689
3538: a0 a0 a0 a0 6c 40 a0 a0  13706
3540: a0 a0 a0 a0 a0 a0 ec c0  13730
3548: a0 a0 a0 a0 a0 a0 a0 a0  13720
3550: a0 a0 6c 40 a0 a0 a0 a0  13730
3558: a0 75 60 60 60 76 a0 a0  13729
3560: ef 41 43 44 6f 70 a0 a0  13761
3568: a0 a0 a0 a0 a0 a0 ef f0  13776
3570: a0 a0 a0 a0 a0 a0 a0 a0  13760
3578: a0 a0 6f 70 ef 41 43 44  13785
3580: a0 4a 79 79 79 4b a0 a0  13803
3588: ec 42 45 46 6c 40 a0 a0  13797
3590: a0 a0 a0 a0 a0 a0 ec c0  13810
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35a0: a0 a0 6c 40 ec 42 45 46  13821
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35b0: 43 44 72 73 61 61 6f 70  13820
35b8: 6f 70 6f 70 6f 70 6f 70  13864
35c0: 6f 70 6f 70 6f 70 6f 70  13872
35c8: 6f 70 61 61 43 44 72 73  13844
35d0: a0 a0 a0 a0 a0 a0 a0 a0  13856
35d8: 47 48 ec 74 61 61 6c 40  13880
35e0: 6c 40 6c 40 6c 40 6c 40  13880
35e8: 6c 40 6c 40 6c 40 6c 40  13888
35f0: 6c 40 61 61 47 48 ec 74  13904
35f8: a0 a0 a0 a0 a0 a0 a0 a0  13896
3600: a0 a0 a0 a0 a0 a0 a0 a0  13904
3608: a0 a0 a0 a0 a0 a0 a0 a0  13912
3610: a0 a0 a0 a0 a0 a0 a0 a0  13920
3618: a0 a0 a0 a0 a0 a0 a0 a0  13928
3620: a0 a0 a0 a0 a0 a0 a0 a0  13936
3628: a0 00 00 00 00 00 00 00  13874
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Extending Basic

Create your own-symbol table, and learn all about tables and search routines

By Burghard-Henry Lehmann

In the last article of this series, we developed a routine which allows us to declare labels for GOTOs and GOSUBs in Basic. We did this with a routine that stores each label and its value in the Basic variable area which follows directly after the Basic textfile.

But with this method we are subject to the limitations Commodore Basic imposes on the use of variables, the main one being that only the first two characters of a variable name are taken into account – the rest are ignored.

What we want to do is overcome this limitation by creating our own symbol table. In the process we will learn about several concepts in machine code programming which will be very useful in whatever programming you want to do.

The Symbol Table

The symbol table we want to create is an area in memory where we store each label, and next to it the line number to which the computer has to jump when the label is used with a GOTO or GOSUB instruction.

In machine code programming, you create many tables. A table is an array of data where each entry is of the same length. Tables are useful for storing data and accessing it quickly and efficiently. For the symbol table we create in our program, I have chosen a memory area starting from location 50000 (you may of course put the symbol table anywhere you like). Thus, 50000 is the base address of our symbol table.

To make each entry the same length, I've chosen a maximum of six recognizable characters for each label. That is, if a label is longer than six characters, the rest will be ignored, and if it's shorter than six characters, the difference will be filled (or "padded") with zeros in the symbol table, as you will see in a minute.

Since we also want to store the line number belonging to each label next to the label, each entry needs an additional two bytes – one byte to store the low byte of the line number, and one byte to store its high byte. This becomes important if the line number is larger than 256.

In all, we use eight bytes for each label stored in the symbol table. Therefore, to point at the beginning of a label, we increment the base address of the table in multiples of eight. And if you call the base address of the table position 0, then the offsets for the first four entries, for example, on the table are 0, 8, 16 and 24.

Now you should understand why it is important that each entry on a table is the same length. If the computer has to search the table from beginning to end, it can very easily jump from entry to entry simply by adding the length of the entry to pointer address. And if it has to jump to a specific entry straight away, it can do so by adding the offset of that entry to the base address of the table.

Storing a Label

The routine to store each label in the symbol table (lines 2910-3450) is quite simple: before the computer starts searching through the Basic program for all the labels, the base address of the symbol table, which is 50000, is initiated to zero page 251/252 (line 2300-233). This allows us to use indirect indexed addressing later on.

When a label has been found, zero page $7A/7B is pointing at the beginning of the label in the Basic textfile. STORELOOP (line 2930-2990) stores each letter of the label in the symbol table, using indirect indexed addressing.

If the label is shorter than six characters, the following loop (line 3060-3100) fills the rest with spaces. Next the line number belonging to the label is stored. To do this we increment zero page 251/252, which stores the pointer to the symbol table, by six (lines 3140-3190).

Now we come up against a little difficulty: we have to use indirect-Y addressing for the source and the destination, but Y has to contain a different value. To point at the source, it has to contain two and three, while to point at the destination it has to contain zero and one.

To solve this problem, table the low byte of the line number first and push it onto the stack (lines 3230-3250). Then get the high byte, change the index to one and store it in the symbol table (lines 3260-3290).

Lastly, decrement that index by one, pull the low byte of the line number from the stack, and store it in the correct place in the symbol table (lines 3300-3320). Such tricks are necessary to overcome the lack of registers the 6510 has got! (Remember, we can't use the X-register here, because X can only be used to index absolute addresses!)

Finally, increment the symbol table pointer address by another two bytes to make it point at the location where the next label has to be entered.

End Marker

When all labels have been collected and entered into the symbol table, enter a zero in the symbol table, where the beginning of the next label would have been (lines 2660-2680).

This is important, because when the computer has to search for a label, it has to know where the end of the symbol table is. Because, if it reaches the end of the symbol table, that means that it hasn't found the label and that the search is finished. If there was no way to determine the end of the symbol table, the computer would go on searching for ever – that is, it would get lost in an endless loop!

To signify the end of a table, it is sometimes useful to use an end marker as we do here. At other times it is more useful to store the end location or the beginning of the last entry in a variable. You have to decide which method is best according to what suits you in the specific routine you are writing.

Searching for a Label

When executing the Basic program itself every time the computer meets a label after a GOTO or GOSUB command, it has to search through the symbol table to find that label and get the line number next to it which it needs to jump to the right destination.

In order to write a search routine you have to ask yourself some very important questions: when is the search successful, and when is it not? This sounds trivial and obvious, but remember, the computer is a very simple-minded animal and knows nothing about what you have in mind! So you have to define things very accurately. This is half the art of programming a computer.

The search for a label is successful when all the six recognized characters of a label in the textfile match with the characters of a label in the symbol table. And the search is unsuccessful when the computer has reached the end of the symbol table and hasn't found the label it was searching for.

Once we've got this clearly in our mind, the construction of the search routine itself is not too difficult. The main search loop (lines 1400-1470) compares each character of the label in the textfile with each character of a particular entry in the symbol table.

It has three exits:

Exit number one is taken if the end of the label in the textfile has been reached. This is signified by a zero (if we make the rule that a label has to be at the end of a Basic line and that nothing else, including remarks, is allowed after it). If this point has been reached it means that the label has been found, even though, if you want to be a perfectionist, you might want to make this routine more accurate and versatile. You can do this by setting up additional tests if the label is not at the end of a line, and if the label in the textfile is shorter than the label in the symbol table.

The second exit of the main loop is taken when any letter in the textfile does not compare with a letter in the symbol table. This does not necessarily mean that the search is unsuccessful at this point. If the label is shorter than six characters, it could mean that it has been found! So lines 1530-1540 test if the next byte in the symbol table contains a zero. If yes, the label has indeed been found. If not, the search has been unsuccessful up to this point.

The third exit is taken after all six recognized characters have been compared and found matching. This means of course that the label has been found.

Now the line number after the label is gathered in zero page $14/15 (lines 1790-1840), and then the GOTO routine is executed (line 1880).

If the label so far has not been found, lines 1590-1650 increment the pointer to the symbol table contained in zero page 251/252 by eight, so that it points at the beginning of the next label. Then a test is made to see if the end of the symbol table has been reached (lines 1710-1730).

If it has, the search has been unsuccessful. This means that the computer cannot get a destination line number. Thus line 1750 returns the program flow back to the main routine which results in a syntax error report, signifying that a label in the Basic program has been used which cannot be found.

```
10              ORG 49152
20              ENT
30    ;
40    CHARGET    EQU $0073
50    EXECVECT   EQU $0308
60    ;
70    SYMBOLTBL  EQU 50000
80    ;
90    ;
100   ;
110   ;TURN EXTENDED BASIC ON
120   ;BY CHANGING VECTOR AT
130   $0308
140   EXTBASON   LDA #<PRGSTART
150              STA <EXECVECT
160              LDA #>PRGSTART
170              STA >EXECVECT
180   ;
190              RTS
200   ;
210   ;
220   ;
230   ;TURN EXTENDED BASIC OFF
240   ;BY CHANGING VECTOR AT
250   $0308
260   ;BACK TO NORMAL ($A7E4)
270   EXTBASOFF  LDA #<$A7E4
280              STA <EXECVECT
290              LDA #>$A7E4
300              STA >EXECVECT
310   ;
320              RTS
330   ;
340   ;
350   ;
360   ;*** MAIN PROGRAM ENTRY *
370   ;
380   ;LOOK FOR EXTENDED BASIC
390   COMMANDS
400   PRGSTART   JSR CHARGET
410              JSR EXECSTM
420              JMP $A7AE
430   ;
440   ;
450   EXECSTM    CMP 'O
460              BNE NEXT
470              JMP OFF.RT
480   NEXT       CMP #$89
                 ;'GOTO'
490              BEQ GOTO.RT
500              CMP #$8A
                 ;'RUN'
510              BNE NEXT1
520              JMP RUN.RT
530   NEXT1      CMP #$8D
                 ;'GOSUB'
540              BNE NEXT2
550              JMP GOSUB.RT
560   NEXT2      CMP '.
                 ;SPECIAL
570              BNE NEXT3
580              JMP SPEC.RT
590   ;
600   NEXT3      CMP 'C
610              BNE NORMAL
620              JSR CHARGET
630              CMP 'O
640              BNE NORMAL
650              JSR CHARGET
660              CMP 'L
670              BNE NORMAL
680              JSR CHARGET
690              CMP #$B0
                 ;'OR' TOKEN
700              BEQ COLOR.RT
710   ;
720   ;
730   ;DO NORMAL ROM-ROUTINE
740   ;
750   NORMAL     JMP $A7ED
760   ;
770   ;
780   ;EXECUTE 'COLOR' COMMAND
790   ;
800   ;GET INK PARAMETER
810   ;
820   COLOR.RT   JSR CHARGET
830              JSR $AD8A
840              JSR $B7F7
850   ;
860   ;CHANGE INK COLOUR
870   ;
880              STY 646
890   ;
900   ;GET PAPER PARAMETER
910   ;
920              JSR CHARGET
930              JSR $AD8A
940              JSR $B7F7
950   ;
960   ;CHANGE PAPER COLOUR
970   ;
980              STY 53281
990   ;
1000  ;GET BORDER PARAMETER
1010  ;
1020             JSR CHARGET
1030             JSR $AD8A
1040             JSR $B7F7
1050  ;
1060  ;CHANGE BORDER COLOUR
1070  ;
1080             STY 53280
1090  ;
1100  ;JUMP TO REST OF ROM-
1110  ; ROUTINE
1120             RTS
1130  ;
1140  ;
1150  ;EXECUTE 'GOTO' COMMAND
1160  ;
1170  GOTO.RT    JSR CHARGET
1180  GOTO.RT1   LDY #0
1190             LDA ($7A),Y
1200             CMP '1
1210             BCC GOTO.RT2
1220             CMP ':
1230             BCS GOTO.RT2
1240             JSR $AD8A
1250             JSR $B7F7
1260  GOTO.RT3   JSR $A8A3
1270             RTS
1280  ;
1290  ;SEARCH FOR LABEL:
1300  ;
1310  ;INITIATE START OF SYMBOL
1320  ; TABLE
1330  GOTO.RT2   LDA #<50000
```

```
1340            STA <251
1350            LDA #>50000
1360            STA >251
1370 ;
1380 ;MAIN SEARCH LOOP
1390 ;
1400            LDY #0
1410 COMPLOOP   LDA ($7A),Y
1420            BEQ POSITIVE
1430            CMP (251),Y
1440            BNE NEGATIVE
1450            INY
1460            CPY #6
1470            BNE COMPLOOP
1480 ;
1490            BEQ POSITIVE
1500 ;
1510 ;SEE IF LABEL SHORTER
1520 ;THAN 6 CHAR
1530 NEGATIVE   LDA (251),Y
1540            BEQ POSITIVE
1550 ;
1560 ;IF NOT. POINT TO BEGINNING OF
1570 ;NEXT ENTRY IN SYMBOL
1580 ;TABLE
1590            CLC
1600            LDA 251
1610            ADC #8
1620            STA 251
1630            LDA 252
1640            ADC #0
1650            STA 252
1660 ;
1670 ;IF END OF SYMBOL TABLE, LABEL
1680 ;NOT FOUND - RETURN TO GIVE
1690 ;ERROR REPORT
1700 ;
1710            LDY #0
1720            LDA (251),Y
1730            BNE COMPLOOP
1740 ;
1750            RTS
1760 ;
1770 ;LABEL FOUND: GET LINE NUMBER
1780 ;
1790 POSITIVE   LDY #6
1800            LDA (251),Y
1810            STA $14
1820            INY
1830            LDA (251),Y
1840            STA $15
1850 ;
1860 ;DO REST OF GOTO ROUTINE
1870 ;
1880            JMP GOTO.RT3
1890 ;
1900 ;
1910 ;
1920 ;EXECUTE 'GOSUB' COMMAND
1930 ;
1940 GOSUB.RT   JSR CHARGET
1950            LDA #$03
1960            JSR $A3FB
1970            LDA $7B
1980            PHA
1990            LDA $7A
2000            PHA
2010            LDA $3A
2020            PHA
2030            LDA $39
2040            PHA
2050            LDA #$8D
2060            PHA
2070            JSR GOTO.RT1
2080            JMP $A7AE
2090 ;
2100 ;
2110 ;
2120 ;IGNORE LABELS
2130 ;
2140 SPEC.RT    JSR CHARGET
2150            BNE SPEC.RT
2160 ;
2170            RTS
2180 ;
2190 ;
2200 ;MODIFIED 'RUN'-ROUTINE
2210 ;
2220 ;DO 'RUN'
2230 ;
2240 RUN.RT     LDA #0
2250            JSR $FF90
2260            JSR $A659
2270 ;
2280 ;INITIATE SYMBOL TABLE
2290 ;
2300            LDA #<SYMBOLTBL
2310            STA <251
2320            LDA #>SYMBOLTBL
2330            STA >251
2340 ;
2350 ;GO THROUGH PRG & ASSEMBLE LABELS
2360 ;
2370            LDA #<$0801
2380            STA <254
2390            LDA #>$0801
2400            STA >254
2410 ;
2420 SEARCHLP   LDY #0
     ;END OF PRG?
2430            LDA (254),Y
2440            BNE SEARCHLP1
2450            INY
2460            LDA (254),Y
2470            BEQ EXIT
2480 SEARCHLP1  LDY #4
2490            LDA (254),Y
2500            CMP '.
2510            BEQ LABLFOUND
2520 SEARCHLP2  LDY #0
     ;NEXT LINE
2530            LDA (254),Y
2540            PHA
2550            INY
2560            LDA (254),Y
2570            STA >254
2580            PLA
2590            STA <254
2600            JMP SEARCHLP
2610 ;
2620 ;
2630 ;ALL DONE - RESET PROGRAM CHARACTER
2640 ;POINTER AND START
2650 ;
2660 EXIT       LDY #0
2670            TYA
2680            STA (251),Y
2690 ;
2700            JSR $A68E
2710            JMP $A7EA
2720 ;
2730 ;
2740 ;
2750 ;STORE LABEL IN SYMBOL TABLE:
2760 ;
2770 ;POINT TO BEGINNING OF LABEL
2780 ;
2790 LABLFOUND  LDA 254
2800            STA $7A
2810            LDA 255
2820            STA $7B
2830            CLC
2840            LDA $7A
2850            ADC #5
2860            STA $7A
2870            LDA $7B
2880            ADC #0
2890            STA $7B
2900 ;
2910 ;STORE LABEL
2920 ;
2930            LDY #0
2940 STORELOOP  LDA ($7A),Y
2950            STA (251),Y
2960            BEQ LABELEND
2970            INY
2980            CPY #6
2990            BNE STORELOOP
3000 ;
3010            BEQ POINTVARS
3020 ;
3030 ;IF LABEL SHORTER THAN 6 CHAR'S
3040 ;FILL REST OF SPACE WITH ZEROS
3050 ;
3060 LABELEND   LDA #0
3070            STA (251),Y
3080            INY
3090            CPY #6
3100            BNE LABELEND
3110 ;
3120 ;POINT AT VARS STORE IN SYMBL TBL
3130 ;
3140 POINTVARS  CLC
3150            LDA #6
3160            ADC 251
3170            STA 251
3180            BNE GETLINENO
3190            INC 252
3200 ;
3210 ;GET LINE NUMBER
3220 ;
3230 GETLINENO  LDY #2
3240            LDA (254),Y
3250            PHA
3260            INY
3270            LDA (254),Y
3280            LDY #1
3290            STA (251),Y
3300            DEY
3310            PLA
3320            STA (251),Y
3330 ;
3340 ;POINT AT NEXT LABEL IN
3350 ;SYMBL TBL
3360            CLC
3370            LDA 251
3380            ADC #2
3390            STA 251
3400            BNE FINIS
3410            INC 252
3420 ;
3430 ;FINISHED
3440 ;
3450 FINIS      JMP SEARCHLP2
3460 ;
3470 ;
3480 ;
3490 ;TEST FOR REST OF 'OFF'
3500 ;
3510 OFF.RT     JSR CHARGET
3520            CMP 'F
3530            BNE NORMAL1
3540            JSR CHARGET
3550            CMP 'F
3560            BNE NORMAL1
3570 ;
3580 ;EXECUTE 'OFF' COMMAND
3590 ;
3600            JSR EXTBASOFF
3610 ;
3620 ;GET NEXT CHARACTER AND
3630 ;JUMP TO REST OF ROM-
3640 ;ROUTINE
3650            JSR CHARGET
3660            RTS
3670 ;
3680 ;
3690 ;
3700 NORMAL1    JMP $A7ED
```

Windows on the C64

Using windows on your C64 couldn't be easier!

By F.E. Randall

This program provides all the facilities you'll need to create a window environment for your Basic programs. These routines can also be used by means of SYS calls typed in from the keyboard. They allow you to specify the size and shape of the windows you require.

When a window is invoked, all the normal screen editing functions are available, but they only operate on the area of the window you have specified. When that window is 'pushed back', the original screen is restored. Up to four windows may be defined, and each may be 'pulled down' in whatever order you determine.

The definition of a window includes its position on the screen, but when 'pulled down', it may be 'dragged' to another position, and it then becomes the new location for that window in subsequent operations.

The areas used by the system are $C000 to $C830 for the machine code, and the screen data is saved under the Basic RAM at $A000 to $BFFF. The locations $F9 to $FE are used for the parameters of the current window, and must not be disturbed whilst the window is 'pulled down' otherwise the system may crash. The original values in these locations are saved each time a window is 'pulled down', and restored when the last window is 'pushed back'.

To achieve the usual screen editing functions whilst only operating on the area of the window, the system includes rewritten parts of the Kernal routines CHRIN and CHROUT. When a window is extant, the vectors at $0324 and $0326 are changed to $C300 and $C000 respectively. Pressing runstop/restore will reset these vectors if you run into difficulties.

How to Use the System

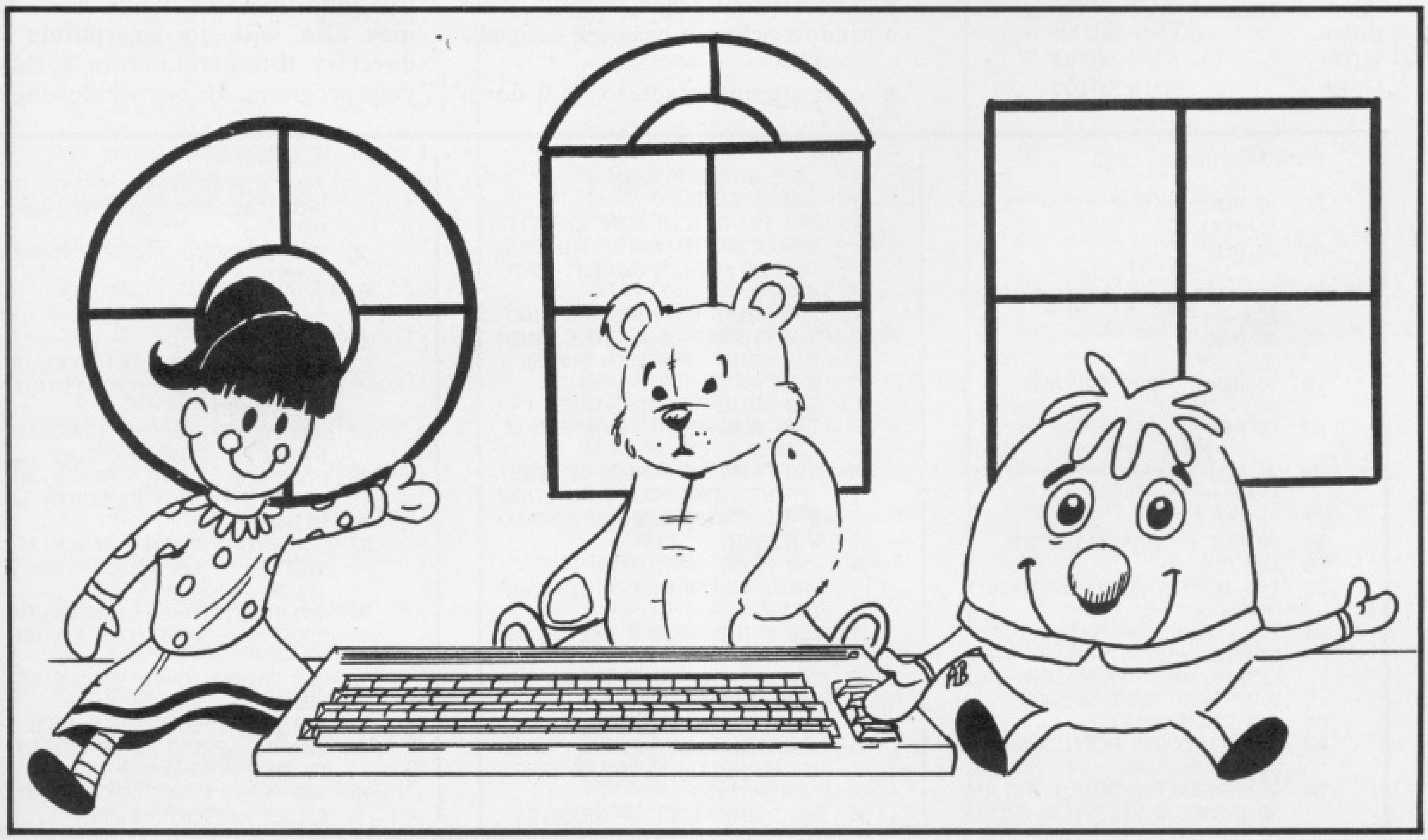
To use the system, you first have to initialise it by SYS 50176. That call should also be used if there has been an error message, since the parameters can be in an indeterminate state after such an event. More about the error messages later.

After initialisation the windows have to be defined by SYS 50179, a, b, c, d, e where:-

a = the window serial number from 1 to 4. This number is used to pull down the window later.
b = the number of the row on the screen where the top left and corner of the window is to appear.
c = the number of the line on which the top left hand corner is to appear.
d = the width of the screen in characters.
e = the number of lines, ie the depth of the window.

The window must be a minimum of three characters wide and three lines deep, and the starting row and line plus the width and depth must not exceed 39 and 24 respectively, since these are dictated by the screen's dimensions. In practice, you'll want to leave ample room for any Basic commands you wish to enter from the window.

This brings me to the one exception to the normal screen editing facilities which the system imposes. Normally there is wrap around on input so that each line may be up to 80 characters



long. In this system the input line is restricted in length to the width of the window you specify. You must make allowances for this when setting the parameters.

The definition of windows will probably come in the initialisation procedures of your program. If you're going to use them to display preset messages, you will probably also want to set up the displays in the initialisation by 'pulling down' the window, PRINTing the text, then 'pushing back' the window. 'Pulling down' is achieved by SYS 50182,a where 'a' is the window number as used in the definition. SYS 50185 will 'push back' the window.

Windows can be redefined without reinitialising the system, but once redefined, the original contents of the window will be lost. Furthermore, if redefinition takes place too frequently, you may run out of space in which to store the contents of the windows. Better to use the same window for different purposes, and clear it by PRINTing "cls" each time.

Dragging Windows

Having 'pulled down' a window, you may drag it round the screen using the following commands:-

up	– SYS 50191
down	– SYS – 50188
left	– SYS 50894
right	– SYS 50197

To drag the window from your Basic program, you would probably want to test for the pressing of a particular function key and then use the appropriate SYS call. For more flexibility, machine code buffs could 'wedge' code into the interrupt routine to check whether a function key is pressed and if so, call the relevant subroutine listed above.

Error Messages

The system generates error messages as shown below to help in debugging your program. The conditions are mostly related to the use of incorrect parameters.

Since the system may be left in an indeterminate state when the error is detected, after displaying the message, the system waits for a key to be pressed before carrying out a warm start. It's always best to initialise the system again after such an occurrence.

The exceptions to this are the absence of parameters following the SYS commands, as this is picked up by the Basic interpreter and results in a SYNTAX ERROR message.

The message displayed will take the form 'ERROR –' followed by a letter. The significances of the letters are as follows:

a – an attempt made to 'pull down' a window before it has been defined.

b – an attempt made to 'pull down' more than four windows or the same window.

c – when defining a window either the start row plus width exceed 39; or the start line plus length exceed 24; or there is no more space to store the window contents.

d – in a window definition, the window number is not in the range one to four.

e – when 'pulling down' a window, the window number is not in the range one to four.

f – in a definition, the window width or length is less than three.

Demonstration Program

Included on the disk is a demonstration program introducing the use of windows. Load and run WINDOWS DEMO. To use the machine code in your own program, type LOAD "WINDOWS MC", 8, 1 then NEW. The demonstration gives you the choice of 'pulling down' windows containing instructions on how to use the system; using a window to view the directory of a disk; defining a window of your own; or 'pulling down' one of the windows used in the program. The latter uses window number two, so if you try to 'pull down' that window, you will get 'ERROR – B'.

If you study the listing of the demonstration program, I'm sure you will soon find all is made clear. You may also wish to incorporate the directory listing routine in some of your programs. Happy windowing!

```
PROGRAM:WINDOWS DEMO

AF  10 REM*****************************
       *******
4F  20 REM*
           *
75  30 REM*   WINDOWS DEMONSTRAT
       ION   *
5B  40 REM*
           *
98  50 REM*   ERIC RANDALL      1
       988   *
67  60 REM*
           *
93  70 REM*****************************
       *******
DF  80 REM
A6  90 REM    INITIALISATION
EB  100 REM
DE  110 IFPEEK(49152)< >72THENLOA
       D"WINDOWS MC",8,1
34  120 POKE52,100:POKE56,100
79  130 INIT=50176:SET=50179:PUL
       L=50182:BACK=50185:DOWN=5018
       8:UP=50191:LEFT=50194
04  140 RIGHT=50197
03  150 POKE53265,PEEK(53265)AND
       239
24  160 SYSINIT:SYSSET,1,3,5,19,
       30:SYSSET,2,2,2,14,30:SYSSET
       ,4,5,8,8,23
4C  170 SYSPULL,1 ·
86  180 PRINT"[CLR,SPC6,RVSON]IN
       STRUCTIONS[RVSOFF]":PRINT"[D
       OWN]INITIALISE SYSTEM - SYS5
       0176
4E  190 PRINT"[DOWN]DEFINE WINDO
       W - SYS50179,A,B,C,D,E  WHER
       E:":PRINT" A=WINDOW NUMBER (
       1 TO 4)
13  200 PRINT" B=START LINE  C=S
       TART ROW":PRINT" D=NUMBER OF
        LINES
78  210 PRINT" E=NUMBER OF ROWS"
       :PRINT"[DOWN]PULL DOWN WINDO
       W - SYS50182,A WHERE A=WINDO
       W NUMBER
D0  220 PRINT"[DOWN]PUSH BACK CU
       RRENT WINDOW -[SPC4]SYS50185
       [DOWN]"
ED  230 PRINT"PRESS A KEY":SYSBA
       CK
E7  240 SYSPULL,4:PRINT"[CLR,DOW
       N]TO DRAG WINDOWS :-
9D  250 PRINT"[DOWN] DOWN  - SYS
       50188 [RVSON]F3[RVSOFF]":PRI
       NT" UP[SPC4]- SYS50191 [RVSO
       N]F4[RVSOFF]"
34  260 PRINT" LEFT  - SYS50194
       [RVSON]F6[RVSOFF]":PRINT" RI
       GHT - SYS50197 [RVSON]F5[RVS
       OFF]"
9D  270 SYSBACK:POKE53265,PEEK(5
       3265)+16
96  280 REM
FE  290 REM    MAIN MENU
A2  300 REM
EA  310 PRINT"[CLR,DOWN,RVSON,SP
       C10]WINDOWS DEMONSTRATION[SP
       C9,RVSOFF]"
F2  320 PRINT"[DOWN3]  [RVSON]1[
       RVSOFF]  -  INSTRUCTIONS
88  330 PRINT"[DOWN]  [RVSON]2[R
       VSOFF]  -  DISK DIRECTORY LI
       STING
57  340 PRINT"[DOWN]  [RVSON]3[R
       VSOFF]  -  DEFINE YOUR OWN W
       INDOW
06  350 PRINT"[DOWN]  [RVSON]4[R
       VSOFF]  -  PULL DOWN A WINDO
       W
51  360 PRINT"[DOWN]  [RVSON]5[R
       VSOFF]  -  EXIT
28  370 PRINT"[DOWN]AFTER EACH E
       XERCISE. PRESS F1 TO EXIT[SP
       C3]FROM A WINDOW
9B  380 PRINT"[DOWN2,SPC6,RVSON]
       SELECT OPTION[RVSOFF]
```

```
C9  390 GETA$:IFA$<"1"ORA$>"5"TH
    EN390
15  400 ONVAL(A$)GOTO410,490,560
    ,660,480
14  410 REM
B1  420 REM     PULL INSTRUCTION
    WINDOW
20  430 REM
8F  440 SYSPULL,1:GOSUB740
0A  450 SYSPULL,4:GOSUB740
05  460 SYSBACK:SYSBACK
D8  470 GOTO390
61  480 END
64  490 REM
83  500 REM     DISPLAY DIRECTORY
70  510 REM
EF  520 SYSPULL,2
C0  530 PRINT"[CLR,SPC4,RVSON]DI
    SK LISTING[RVSOFF]":PRINT"IN
    SERT DISK AND PRESS A KEY"
E0  540 GETA$:IFA$=""THEN540
E0  550 GOSUB850:GOSUB740:SYSBAC
    K:GOTO390
BD  560 REM
C7  570 REM     DEFINE A WINDOW
C9  580 REM
BE  590 SYSPULL,1:PRINT"[CLR,SPC
    4,RVSON]DEFINE WINDOW[RVSOFF
    ]":PRINT"[DOWN2]YOUR WINDOW
    WILL BE NUMBER 3
BE  600 A=3:PRINT"[DOWN] START L
    INE";:INPUTB:PRINT"START ROW
    ";:INPUTC
6D  610 PRINT"NUMBER OF LINES";:
    INPUTD:PRINT"NUMBER OF ROWS"
    ;:INPUTE
07  620 SYSSET,A,B,C,D,E:SYSPULL
    ,A
50  630 PRINT"[CLR]THIS IS YOUR
    WINDOW.  USE THE CURSER AND
    HOME CONTROLS TO SET UP";
ED  640 PRINT"THE DISPLAY IN THI
    S WINDOW THEN PRESS RETURN
07  650 INPUTA$:SYSBACK:SYSBACK:
    GOTO390
19  660 REM
95  670 REM     PULL DOWN A WINDO
    W
25  680 REM
F5  690 SYSPULL,2:PRINT"[CLR,SPC
    3,RVSON]PULL DOWN A WINDOW[R
    VSOFF]
1A  700 PRINT"[DOWN2]WHICH WINDO
    W (1, 3 OR 4)":INPUTA
4C  705 IFA<1ORA>4ORA=2THEN700
DE  710 SYSPULL,A
D2  720 GOSUB740
0B  730 SYSBACK:SYSBACK:GOTO390
69  740 REM
17  750 REM     CHECK WHICH KEY PR
    ESSED
0D  760 REM    AND MOVE WINDOW
8A  770 REM
75  780 GETA$:IFA$=""THEN780
2E  960 D=3-LEN(STR$(C)):D=E
D2  970 PRINT"[RVSON]"MID$(STR$(
    C),2);TAB(3+E);"[RVSOFF]";
80  980 FORJ=0TOD:PRINT" ";:NEXT
AF  990 GET#1,B$:IF ST<>0 THEN 1
    090
42  1000 IF B$<>CHR$(34) THEN 99
    0
60  1010 GET#1,B$:IF B$<>CHR$(34
    )THEN PRINTB$;:GOTO1010
2C  1020 GET#1,B$:IF B$=CHR$(32)
    THEN 1020
A9  1030 PRINT TAB(21+E);:C$=""
06  1040 C$=C$+B$:GET#1,B$:IF B$
    <>""  THEN 1040
EB  1050 PRINT"[RVSON]"LEFT$(C$,
    3)
0C  1060 IFZ=0THENPRINT:Z=Z+1
DB  1070 P=P+1:IFP=10THEN1110
7B  1080 IF ST=0 THEN 910
AD  1090 PRINT" BLOCKS FREE"
4D  1100 CLOSE1:CLOSE2:RETURN
B6  1110 PRINT"[RVSON]PRESS A KE
    Y[RVSOFF]"
4D  1120 GETA$:IFA$=""THEN1120
FC  1130 P=0:GOTO1080
```

PROGRAM:WINDOWS.BAS

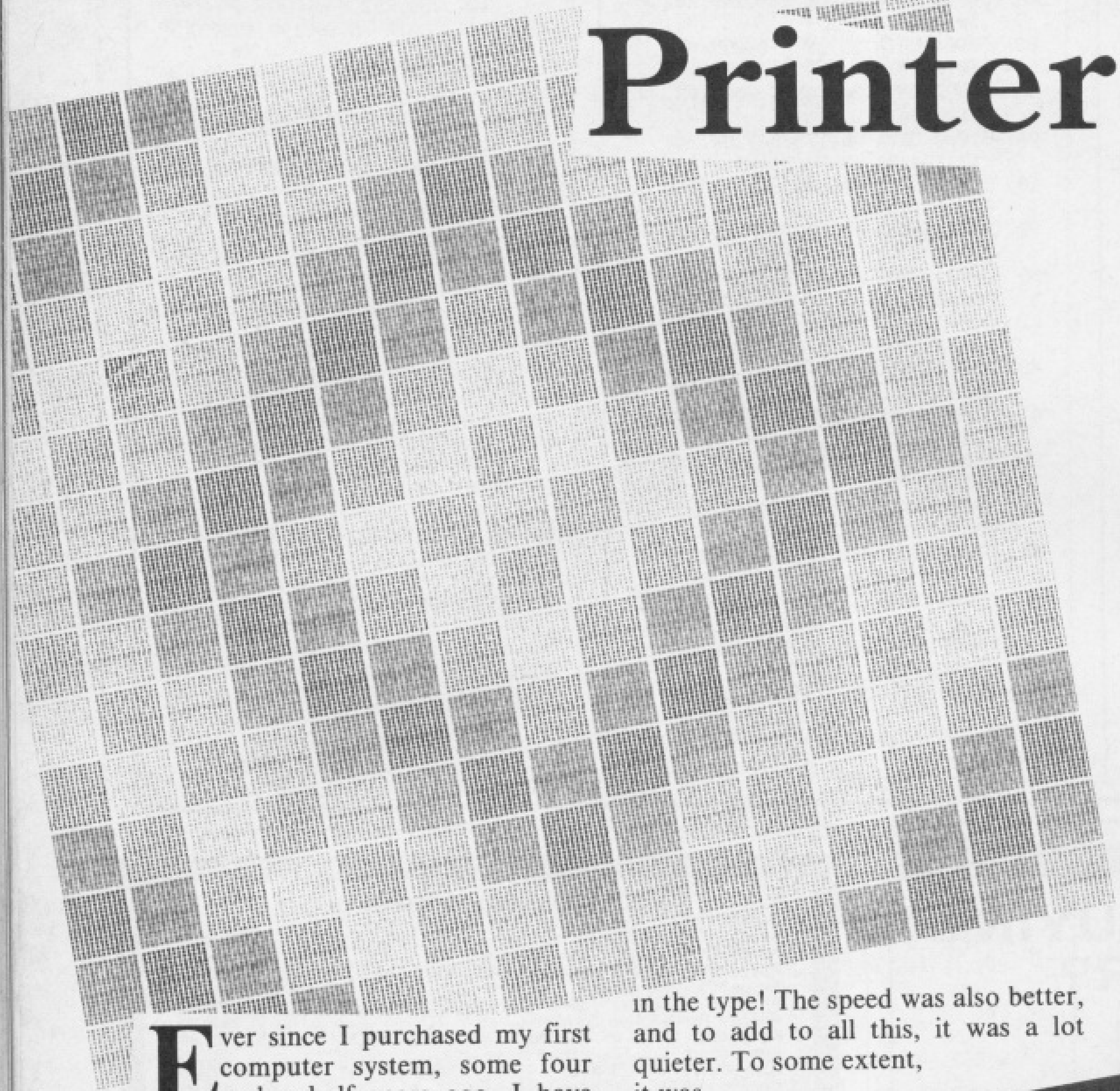
```
32  10 I=49152
2E  20 READ A:IF A=256 THEN END
57  30 POKE I,A:I=I+1:GOTO 20
7F  49152 DATA 72,133,215,165,15
    4,201,3,240
43  49160 DATA 4,104,76,202,241,
    138,72,152
90  49168 DATA 72,169,0,133,208,
    164,211,165
F1  49176 DATA 215,16,3,76,181,1
    92,201,13
9E  49184 DATA 208,3,76,62,194,2
    01,32,144
8D  49192 DATA 16,201,96,144,4,4
    1,223,208
4F  49200 DATA 2,41,63,32,132,23
    0,76,70
F6  49208 DATA 193,166,216,240,3
    ,76,74,193
F0  49216 DATA 201,20,208,43,152
    ,208,6,32
5E  49224 DATA 113,194,76,100,19
    2,136,132,211
48  49232 DATA 32,36,234,200,177
    ,209,136,145
C1  49240 DATA 209,200,177,243,1
    36,145,243,200
56  49248 DATA 196,254,208,239,1
    69,32,145,209
FE  49256 DATA 173,134,2,145,243
    ,16,58,166
CE  49264 DATA 212,240,3,76,74,1
    93,201,18
DD  49272 DATA 208,2,133,199,201
    ,19,208,3
A7  49280 DATA 76,48,194,201,29,
    208,6,76
3D  49288 DATA 99,194,76,168,230
    ,201,17,208
0D  49296 DATA 27,152,72,165,251
    ,24,101,253
F3  49304 DATA 197,214,208,9,32,
    129,193,104
CE  49312 DATA 133,211,76,168,23
    0,104,76,83
8A  49320 DATA 194,76,168,230,32
    ,203,232,76
F4  49328 DATA 68,236,76,68,236,
    41,127,201
35  49336 DATA 127,208,2,169,94,
    201,32,144
46  49344 DATA 3,76,68,193,201,1
    3,208,3
5A  49352 DATA 76,62,194,166,212
    ,208,52,201
66  49360 DATA 20,208,44,164,254
    ,177,209,201
29  49368 DATA 32,208,33,164,254
    ,32,36,234
B5  49376 DATA 136,177,209,200,1
    45,209,136,177
75  49384 DATA 243,200,145,243,1
    36,196,211,208
EA  49392 DATA 239,169,32,145,20
    9,173,134,2
0E  49400 DATA 145,243,230,216,7
    6,168,230,166
F4  49408 DATA 216,240,5,9,64,76
    ,74,193
74  49416 DATA 201,17,208,14,166
    ,214,228,251
5F  49424 DATA 240,5,198,214,32,
    135,194,76
5A  49432 DATA 168,230,201,18,20
    8,4,169,0
22  49440 DATA 133,199,201,29,20
    8,15,152,240
74  49448 DATA 6,136,132,211,76,
    168,230,32
DF  49456 DATA 113,194,76,168,23
    0,201,19,208
6B  49464 DATA 3,76,18,194,9,128
    ,32,203
DE  49472 DATA 232,76,79,236,9,6
    4,166,199
B2  49480 DATA 240,2,9,128,166,2
    16,240,2
83  49488 DATA 198,216,174,134,2
    ,32,19,234
DA  49496 DATA 76,99,194,166,214
    ,228,252,240
6F  49504 DATA 2,230,214,96,162,
    0,134,216
C7  49512 DATA 134,199,134,212,1
    34,211,32,116
F0  49520 DATA 193,76,168,230,70
    ,201,166,214
25  49528 DATA 232,228,252,208,3
    ,32,129,193
14  49536 DATA 96,165,172,72,165
    ,173,72,165
EB  49544 DATA 174,72,165,175,72
    ,32,210,193
FF  49552 DATA 32,250,193,166,25
    3,164,254,177
9B  49560 DATA 172,145,209,177,1
    74,145,243,136
54  49568 DATA 16,245,165,173,13
    3,210,165,175
DB  49576 DATA 133,244,165,172,1
    33,209,133,243
BC  49584 DATA 32,250,193,202,20
    8,223,164,254
97  49592 DATA 169,32,145,209,17
    3,134,2,145
50  49600 DATA 243,136,16,244,16
    5,251,24,101
A4  49608 DATA 253,133,214,169,0
    ,133,211,76
14  49616 DATA 56,233,169,4,133,
    210,169,216
D3  49624 DATA 133,244,169,0,166
    ,251,240,12
24  49632 DATA 24,105,40,144,4,2
    30,210,230
AE  49640 DATA 244,202,208,244,2
    4,101,252,144
DE  49648 DATA 4,230,210,230,244
    ,133,209,133
29  49656 DATA 243,96,165,210,13
    3,173,165,244
91  49664 DATA 133,175,165,209,2
    4,105,40,144
C7  49672 DATA 4,230,173,230,175
    ,133,172,133
E4  49680 DATA 174,96,32,210,193
    ,166,253,134
12  49688 DATA 214,169,32,164,25
    4,145,209,136
44  49696 DATA 16,251,165,209,24
    ,105,40,144
22  49704 DATA 2,230,210,133,209
    ,202,16,233
59  49712 DATA 32,210,193,166,25
    1,134,214,162
45  49720 DATA 0,134,211,76,168,
    230,162,0
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F2  49728 DATA 134,211,134,212,1
    65,251,24,101
6D  49736 DATA 253,197,214,208,6
    ,32,129,193
47  49744 DATA 76,168,230,230,21
    4,24,165,209
46  49752 DATA 105,40,144,2,230,
    210,133,209
51  49760 DATA 76,168,230,230,21
    1,165,254,197
90  49768 DATA 211,16,3,76,62,19
    4,76,168
1E  49776 DATA 230,166,214,228,2
    51,208,9,162
6C  49784 DATA 0,134,211,104,104
    ,76,168,230
3A  49792 DATA 202,134,214,164,2
    54,132,211,165
94  49800 DATA 209,56,233,40,176
    ,2,198,210
AC  49808 DATA 133,209,96,0,0,0,
    0,0
ED  49816 DATA 0,0,0,0,0,0,0,0
F5  49824 DATA 0,0,0,0,0,0,0,0
FD  49832 DATA 0,0,0,0,0,0,0,0
05  49840 DATA 0,0,0,0,0,0,0,0
8D  49848 DATA 0,0,0,0,0,0,0,0
95  49856 DATA 0,0,0,0,0,0,0,0
9D  49864 DATA 0,0,0,0,0,0,0,0
A5  49872 DATA 0,0,0,0,0,0,0,0
2D  49880 DATA 0,0,0,0,0,0,0,0
35  49888 DATA 0,0,0,0,0,0,0,0
3D  49896 DATA 0,0,0,0,0,0,0,0
45  49904 DATA 0,0,0,0,0,0,0,0
CD  49912 DATA 0,0,0,0,0,0,0,0
DA  49920 DATA 165,153,208,11,16
    5,211,133,202
40  49928 DATA 165,214,133,201,7
    6,31,195,201
5D  49936 DATA 3,208,9,133,208,1
    65,254,133
0D  49944 DATA 200,76,31,195,76,
    115,241,152
7A  49952 DATA 72,138,72,165,208
    ,240,65,164
D5  49960 DATA 211,177,209,133,2
    15,41,63,6
75  49968 DATA 215,36,215,16,2,9
    ,128,144
6B  49976 DATA 4,166,212,208,4,1
    12,2,9
25  49984 DATA 64,230,211,32,132
    ,230,196,200
0E  49992 DATA 240,3,76,116,230,
    169,0,133
77  50000 DATA 208,169,13,166,15
    3,224,3,240
70  50008 DATA 6,166,154,224,3,2
    40,3,32
1F  50016 DATA 199,195,76,114,23
    0,32,199,195
A2  50024 DATA 165,198,133,204,1
    41,146,2,240
30  50032 DATA 247,120,165,207,2
    40,12,165,206
9A  50040 DATA 174,135,2,160,0,1
    32,207,32
C2  50048 DATA 19,234,32,180,229
    ,201,131,208
95  50056 DATA 16,162,9,120,134,
    198,189,230
B1  50064 DATA 236,157,118,2,202
    ,208,247,240
7A  50072 DATA 207,201,13,208,20
    0,164,254,132
1F  50080 DATA 208,177,209,201,3
    2,208,3,136
69  50088 DATA 208,247,200,132,2
    00,160,0,140
BB  50096 DATA 146,2,132,211,132
    ,212,165,201
C3  50104 DATA 197,214,208,8,165
    ,202,133,211
B7  50112 DATA 197,200,176,137,7
    6,39,195,76
1F  50120 DATA 0,192,45,195,76,0
    ,192,0
A4  50128 DATA 0,0,0,0,0,0,0,0
2C  50136 DATA 0,0,0,0,0,0,0,0
34  50144 DATA 0,0,0,0,0,0,0,0
3C  50152 DATA 0,0,0,0,0,0,0,0
44  50160 DATA 0,0,0,0,0,0,0,0
CC  50168 DATA 0,0,0,0,0,0,0,0
BD  50176 DATA 76,24,196,76,202,
    196,76,119
AD  50184 DATA 198,76,236,198,76
    ,171,199,76
29  50192 DATA 80,199,76,123,199
    ,76,144,199
43  50200 DATA 162,36,169,255,15
    7,224,199,202
3C  50208 DATA 16,250,169,0,141,
    32,200,141
BC  50216 DATA 4,200,141,6,200,1
    69,160,141
9D  50224 DATA 5,200,141,7,200,1
    60,3,185
78  50232 DATA 36,3,153,28,200,1
    36,16,247
08  50240 DATA 96,32,253,174,32,
    138,173,32
05  50248 DATA 247,183,192,0,96,
    173,32,200
3C  50256 DATA 208,10,162,5,181,
    249,157,8
4C  50264 DATA 200,202,16,248,96
    ,165,253,201
B1  50272 DATA 3,16,5,169,70,76,
    203,198
11  50280 DATA 165,254,201,3,48,
    245,165,251
EE  50288 DATA 24,101,253,201,25
    ,48,5,169
6D  50296 DATA 67,76,203,198,165
    ,252,24,101
29  50304 DATA 254,201,40,16,242
    ,169,0,168
B6  50312 DATA 230,254,166,253,2
    4,101,254,144
64  50320 DATA 1,200,202,16,247,
    133,98,132
D9  50328 DATA 99,198,254,24,109
    ,6,200,144
61  50336 DATA 1,200,133,100,152
    ,24,109,7
99  50344 DATA 200,201,192,176,2
    02,133,101,165
7A  50352 DATA 100,164,101,24,10
    1,98,144,5
46  50360 DATA 200,192,192,176,1
    86,133,98,152
91  50368 DATA 24,101,99,201,192
    ,176,176,133
68  50376 DATA 99,96,32,77,196,1
    69,0,72
3D  50384 DATA 32,65,196,104,170
    ,152,149,250
EA  50392 DATA 232,138,201,5,240
    ,3,72,208
5D  50400 DATA 239,165,250,16,5,
    169,68,76
AF  50408 DATA 207,198,240,249,2
    01,5,16,245
95  50416 DATA 141,14,200,32,93,
    196,32,197
10  50424 DATA 197,174,32,200,23
    6,17,200,48
68  50432 DATA 3,76,130,198,160,
    3,162,3
D6  50440 DATA 181,251,145,249,2
    02,136,16,248
41  50448 DATA 160,4,173,6,200,1
    45,249,200
BA  50456 DATA 173,7,200,145,249
    ,200,165,100
00  50464 DATA 145,249,200,165,1
    01,145,249,165
78  50472 DATA 98,141,6,200,165,
    99,141,7
2F  50480 DATA 200,32,156,198,32
    ,211,199,169
72  50488 DATA 147,32,0,192,164,
    254,166,253
32  50496 DATA 136,202,169,111,1
    45,209,136,208
FE  50504 DATA 251,32,105,197,16
    0,0,169,106
AA  50512 DATA 145,209,164,254,1
    69,116,145,209
4C  50520 DATA 202,208,238,32,18
    5,197,169,119
10  50528 DATA 164,254,136,145,2
    09,192,1,208
7B  50536 DATA 249,169,19,32,0,1
    92,165,243
0C  50544 DATA 133,209,165,244,1
    33,210,169,15
0F  50552 DATA 166,253,164,254,1
    45,209,136,16
6A  50560 DATA 251,168,32,185,19
    7,152,202,16
5B  50568 DATA 241,169,19,32,0,1
    92,32,198
03  50576 DATA 199,76,236,198,32
    ,77,196,32
7B  50584 DATA 65,196,208,5,169,
    69,76,203
AF  50592 DATA 198,192,5,16,247,
    140,14,200
46  50600 DATA 96,32,197,197,162
    ,3,160,3
17  50608 DATA 177,249,149,251,2
    02,136,16,248
6D  50616 DATA 96,165,209,24,105
    ,40,144,2
DA  50624 DATA 230,210,133,209,9
    6,169,199,141
66  50632 DATA 16,200,169,224,17
    4,14,200,202
73  50640 DATA 240,11,24,105,8,1
    44,3,238
CC  50648 DATA 16,200,202,208,24
    5,141,15,200
9D  50656 DATA 133,249,173,16,20
    0,133,250,96
E7  50664 DATA 120,165,1,41,254,
    133,1,173
23  50672 DATA 15,200,133,249,17
    3,16,200,133
7E  50680 DATA 250,173,136,2,133
    ,210,32,52
06  50688 DATA 198,160,4,32,42,1
    98,32,71
2C  50696 DATA 198,173,136,2,41,
    3,9,216
69  50704 DATA 133,210,32,52,198
    ,160,6,32
0B  50712 DATA 42,198,32,71,198,
    173,136,2
1A  50720 DATA 133,210,165,1,9,1
    ,133,1
8F  50728 DATA 88,96,177,249,133
    ,34,200,177
92  50736 DATA 249,133,35,96,165
    ,252,166,251
32  50744 DATA 240,10,24,105,40,
    144,2,230
4A  50752 DATA 210,202,208,246,1
    33,209,96,166
D4  50760 DATA 253,164,254,177,2
    09,72,177,34
F2  50768 DATA 145,209,104,145,3
    4,136,16,243
9A  50776 DATA 202,48,27,164,254
    ,200,152,24
46  50784 DATA 101,34,144,2,230,
    35,133,34
CE  50792 DATA 169,40,24,101,209
    ,144,2,230
69  50800 DATA 210,133,209,24,14
    4,211,96,32
4B  50808 DATA 77,196,174,32,200
    ,236,17,200
E5  50816 DATA 48,5,169,66,76,20
    7,198,32
5E  50824 DATA 148,197,174,32,20
    0,202,189,33
34  50832 DATA 200,205,14,200,24
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   0,236,32,197
BD 50840 DATA 197,32,45,199,174
   ,32,200,173
05 50848 DATA 14,200,157,33,200
   ,238,32,200
9B 50856 DATA 32,169,197,32,232
   ,197,32,198
1E 50864 DATA 199,169,0,141,38,
   3,169,192
A2 50872 DATA 141,39,3,169,0,14
   1,36,3
C4 50880 DATA 169,195,141,37,3,
   169,19,32
B5 50888 DATA 210,255,96,168,10
   4,104,152,72
8C 50896 DATA 162,0,189,18,200,
   240,6,32
97 50904 DATA 210,255,232,208,2
   45,104,32,210
EA 50912 DATA 255,169,0,133,198
   ,165,198,240
F2 50920 DATA 252,76,102,254,17
   4,32,200,240
95 50928 DATA 32,32,211,199,32,
   232,197,206
14 50936 DATA 32,200,174,32,200
   ,202,48,18
CC 50944 DATA 189,33,200,141,14
   ,200,32,169
8E 50952 DATA 197,32,198,199,16
   9,19,32,0
A6 50960 DATA 192,96,162,3,189,
   28,200,157
5A 50968 DATA 36,3,202,16,247,1
   62,5,189
E4 50976 DATA 8,200,149,249,202
   ,16,248,169
83 50984 DATA 19,32,210,255,96,
   160,0,177
CA 50992 DATA 249,48,6,200,192,
   4,208,247
9A 51000 DATA 96,173,32,200,240
   ,13,174,32
C3 51008 DATA 200,202,189,33,20
   0,141,14,200
70 51016 DATA 32,197,197,169,65
   ,76,203,198
36 51024 DATA 173,32,200,240,5,
   164,251,136
C2 51032 DATA 208,1,96,32,211,1
   99,32,232
48 51040 DATA 197,198,251,32,23
   2,197,162,3
41 51048 DATA 160,3,181,251,145
   ,249,202,136
EA 51056 DATA 16,248,32,198,199
   ,169,19,32
92 51064 DATA 0,192,96,173,32,2
   00,240,218
8A 51072 DATA 164,252,136,240,2
   13,32,211,199
D6 51080 DATA 32,232,197,198,25
   2,76,99,199
54 51088 DATA 173,32,200,240,19
   7,169,1,24
22 51096 DATA 101,254,101,252,2
   01,39,240,186
C9 51104 DATA 32,211,199,32,232
   ,197,230,252
0E 51112 DATA 76,99,199,173,32,
   200,240,170
E6 51120 DATA 169,1,24,101,251,
   101,253,201
35 51128 DATA 24,240,159,32,211
   ,199,32,232
9F 51136 DATA 197,230,251,76,99
   ,199,230,251
E7 51144 DATA 230,252,198,253,1
   98,253,198,254
FA 51152 DATA 198,254,96,198,25
   1,198,252,230
50 51160 DATA 253,230,253,230,2
   54,230,254,96
F8 51168 DATA 0,0,0,0,0,0,0,0
00 51176 DATA 0,0,0,0,0,0,0,0
88 51184 DATA 0,0,0,0,0,0,0,0
10 51192 DATA 0,0,0,0,0,0,0,0
DF 51200 DATA 0,0,0,0,0,0,0,0
E7 51208 DATA 0,0,0,0,0,0,0,0
C8 51216 DATA 0,4,13,69,82,82,7
   9,82
99 51224 DATA 32,45,32,0,87,241
   ,202,241
7F 51232 DATA 0,0,0,0,0,0,0,0
9C 51240 DATA 0,0,0,256

READY.
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Star LC10-C Colour Printer



We put the LC10-C under the microscope

By Paul Eves

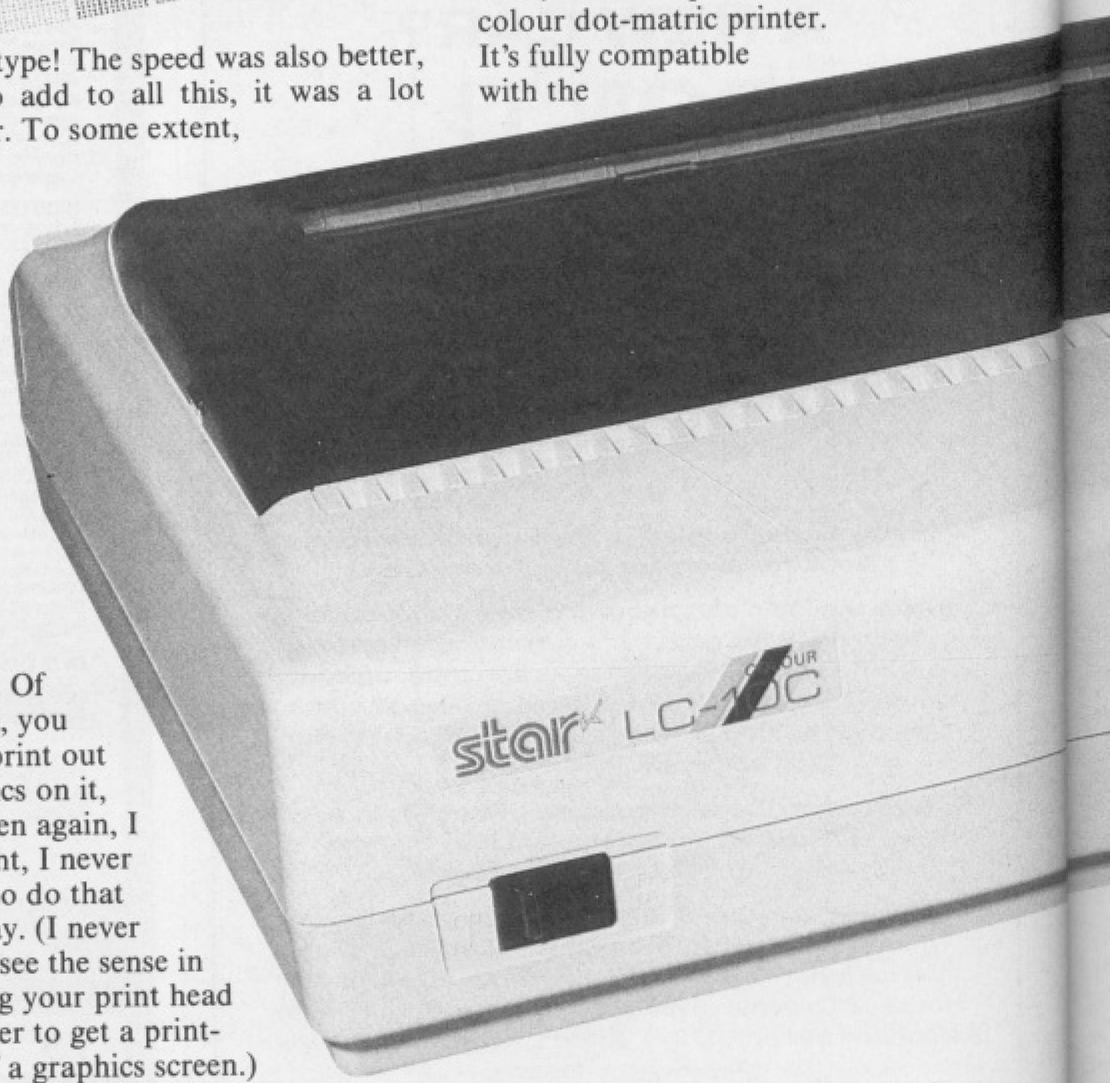
Ever since I purchased my first computer system, some four and a half years ago, I have always understood the importance of having a printer. Even in those early days as a complete novice, I could see the importance of being able to get hard copies of any important work done, be it listings of your latest masterpiece, print-outs of your finances, or simply letters.

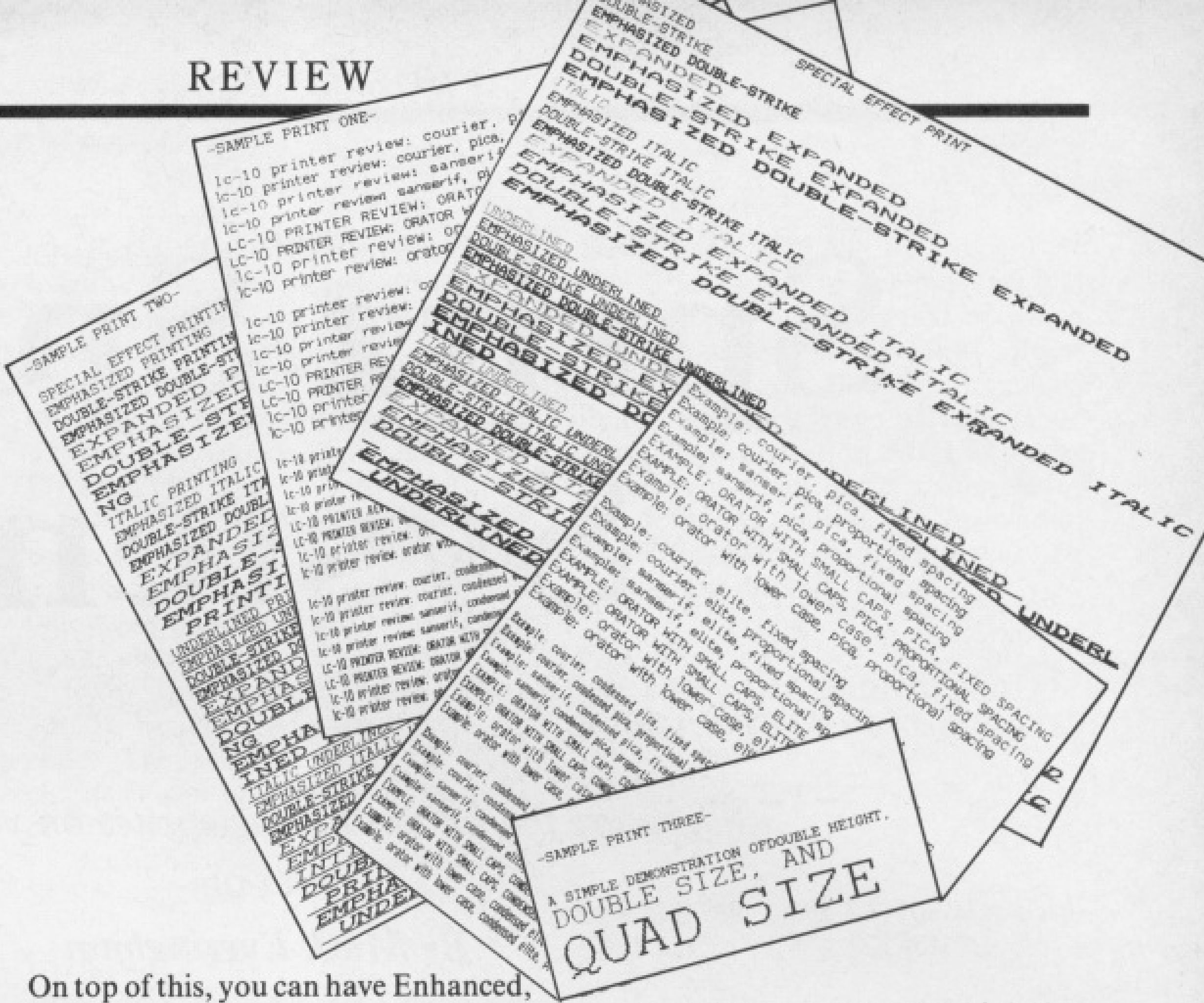
The first printer I bought was the MPS801, and at the time it seemed like a good buy. I was able to get print-outs of virtually anything I desired with relative ease. True, the finished result was not spectacular, but it was something – better than my handwriting, I can assure you. However, when I looked around at my friends' listings, lists and letters, I was somewhat miffed to discover that my humble 801 was perhaps not quite as good as I had first thought.

Not to be outdone, I traded in the 801 and upgraded to the 802. Ah, what bliss! This printer had a far superior finish to it. Alright, so it is a lot larger and heavier, but what an improvement in the type! The speed was also better, and to add to all this, it was a lot quieter. To some extent, it was also a lot easier to use. Of course, you can't print out graphics on it, but then again, I thought, I never want to do that anyway. (I never could see the sense in ruining your print head in order to get a print-out of a graphics screen.)

Shortly after this, I began reviewing programs for *Your Commodore*. Yes, you've guessed it, suddenly the need for graphics printing became only too clear. Back went the 802, and I said hello once again to the 801.

Since those early days, I have used many different printers. These machines, like Assemblers, come in all sorts of formats. Some will do one thing, others will do another. It's not often you find a printer that will do EVERYTHING you personally want it to do. That is to say, until 14 months ago, when I discovered the LC10-C. For my money this has got to be one of the best home-use printers I've ever come across. So what makes this printer stand out above the rest? Well, it's a compact, convenient, colour dot-matric printer. It's fully compatible with the





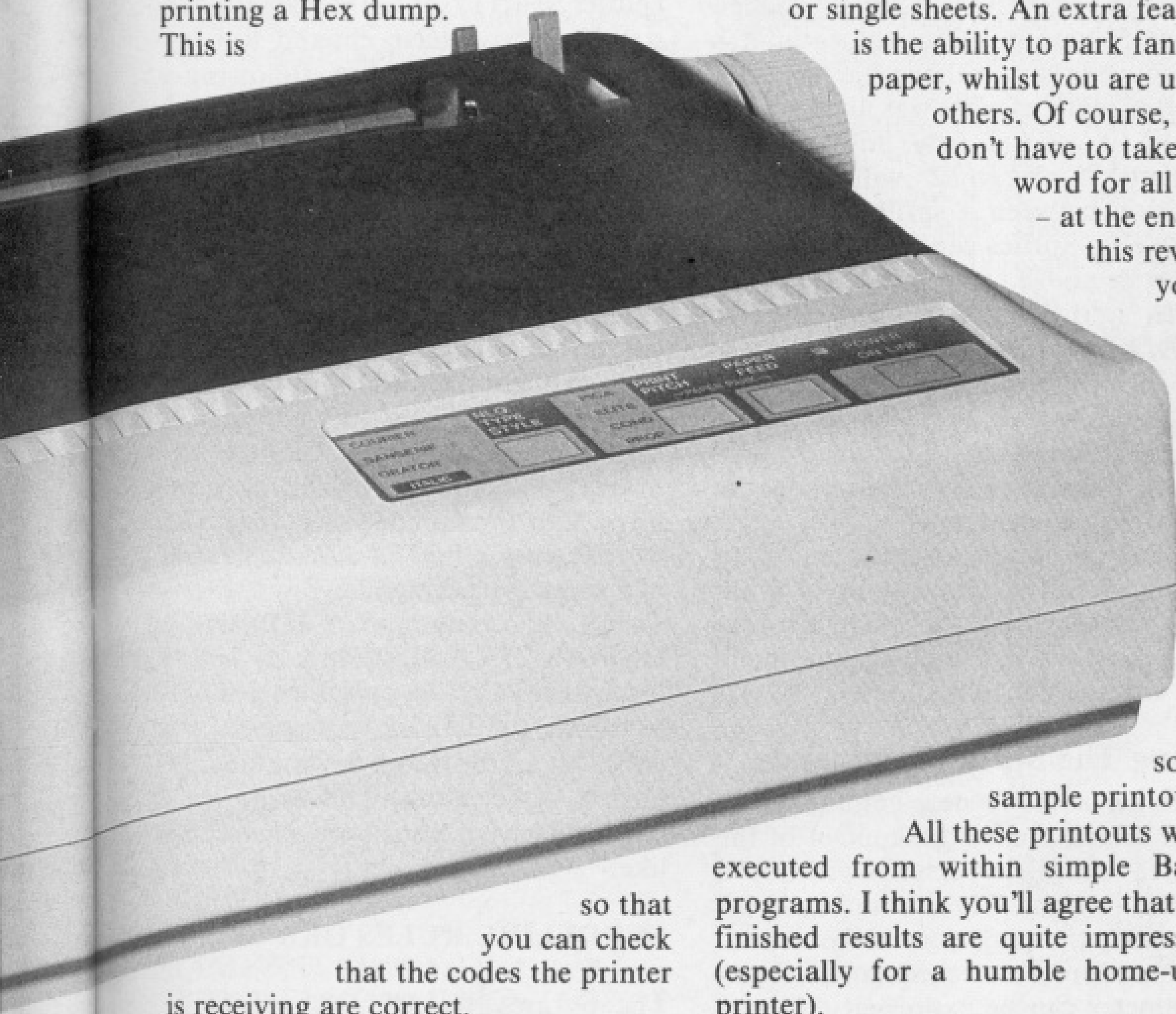
C128 and C64, it supports the Commodore graphics and business character sets, (Standard and DIN versions), and you can also swap to ASCII operating mode.

On top of all this, you have access to no less than ten international character sets. For those of you who like colourful displays and print-outs, you have a six colour print option. Operating the printer is simplicity itself. You are provided with a clear, easy to read front panel, and from this panel a multitude of operations can be performed.

Apart from the obvious function of switching power on or off, these are the other functions available:

The type style can be selected along with the type pitch. Left and right margins can be set up along with setting the top of paper, and paper can be fed automatically with micro-feed if needed (forward or reverse). Pause printing and the printing of test patterns are both possible.

You can also prevent software from altering your pitch and style settings. One other function, which I think is a boon to machine code programmers, is the facility for printing a Hex dump. This is so that you can check that the codes the printer is receiving are correct.



Five type styles are catered for, all of which can be used in italics (one draft and Four NLQ). There are then four different print pitches for each. On top of this, you can have Enhanced, Underlined, Superscript, Subscript, Bold, Double sized and Quadruple sized printing. The printer also prints standard eight-bit graphics and Commodore seven-bit graphics. You can use up to triple-ply multi-copy forms, normal fanfold forms or single sheets. An extra feature is the ability to park fanfold paper, whilst you are using others. Of course, you don't have to take my word for all this – at the end of this review you'll see some sample printouts.

All these printouts were executed from within simple Basic programs. I think you'll agree that the finished results are quite impressive (especially for a humble home-user printer).

As well as everything else I've said, the supporting manual is well laid out, informative and easy to understand. *(It must be if he understands it... Ed!)*

But I don't want you to think that I have no criticisms at all, because I have. All this Hi-Tech equipment is somewhat delicate. I had great trouble for some time getting it to respond to colour commands, both from within software and by direct use. I just could not understand what the problem was (the test patterns proved OK).

Eventually I hit on the problem. My ribbon had by this time become faint on Black and Blue. For some reason this interfered with the operation of the rest of the ribbon. On purchasing a new ribbon, the problem disappeared. It would be better if this could be overcome, but I think that this is a small price to pay considering the advantages the machine has.

In the final analysis, I would highly recommend this printer. I know there must be better ones around, the 24 pin type for example, But for all-round versatility, it is hard to beat.

Final Word

The printer that was reviewed here is the Commodore Serial Interfaced Version. There is a Centronics Version that's compatible with Epsom and IBM printers. Therefore this version is suitable with the Amiga and any other computer that supports these printers.

Touchline:
Star Micronics, Craven House, 40 Uxbridge Rd, Ealing W5 2BS. ***Telephone:*** *(01) 840 1800.*

Spritz Sprite System

If you are fed up not having sprites on your Plus/4, read on

By Mark Everingham

A sprite, according to the Concise Oxford Dictionary is, "An Elf, Fairy or Hobgoblin." Hmmm... Maybe, but perhaps the definition should extend to include Cars, Planes, Pacmen, Invaders from Space and (just for Jeff Minter) Sheep, Camels and Llamas.

In fact, in computer terms, a sprite is any piece of computer graphics which plays an active part in a game. Sadly, the Plus/4 does not have any, a fact which has been long lamented by the machine's owners who have to bear the ridicule of C64 owners, whose machines are endowed with hardware—controlled sprites.

Spritz sets out to put the balance right by providing your Plus/4 computer with a comprehensive Sprite System, giving not one, not two, but eight independant, full colour sprites which can be controlled very simply through 19 new commands. These commands are added to the standard Commodore Basic language – no need for those engless pokes for which the C64 has become infamous!

The Theory Of Sprites

Sprites form the heart of the majority of today's computer games, and are found in abundance on every computer, from the humble C16 to the mighty CBM Amiga. A sprite is a graphic element or picture which can be placed on the screen and moved quickly and smoothly about with the minimum of trouble.

On the Plus/4, the text screen is used for sprites because of the speed and ease of use this screen offers. When a sprite is displayed, the computer automatically remembers what was under the sprite before it was printed. To move the sprite you simply change its coordinate position, the computer acknowledges that the sprite has been moved, replaces what was underneath, moves it to the new position and reprints it. *SPRITZ* will detect a collision between a sprite and something else. Sprites can even be printed below or above foreground graphics.

In addition to these features, *SPRITZ* also has a facility for selective priority printing, a feature not found on either the C64 or C128. *SPRITZ* handles this complicated process in about 20 milliseconds under the control of an interrupt.

If it all sounds a little technical, remember, all you have to do is to tell the computer where to move a sprite, everything else is completely automatic and transparent to the user.

Using The Spritz Commands

SPRITZ adds 19 new commands to basic which makes the control of the sprites simplicity itself, without a POKE in sight. These commands act in exactly the same way as the normal Commodore Basic commands. Every parameter can be expressed either as direct numbers or variables. Standard error messages are given which can, if required, be intercepted in Basic using the Commodore TRAP command.

The error messages *SPRITZ* gives are explained below:

?SYNTAX Error – You have either, used a command or keyword that neither SPRITZ or CBM Basic understands, or you have entered too few or too many parameters following a command.

?Type Mismatch Error – you have replaced a numeric parameter with a string.

?Illegal Quantity Error – One number you have used as a command parameter is outside the valid range for that particular command.

As well as these error messages, the Basic **HELP** command (Key F8), also works with *SPRITZ* commands. If you enter something like:-

DEFINE 255, 1, 2, 3, 4, 5, 6, 7, 8, 9
when there should only be the numbers 1-8 the **HELP** command will make all of the line from the final '9' flash to indicate where the error lies.

Similarly, if you typed something like:-

SCROLLING RULES OK

The phrase 'RULES OK' would be flashing as the valid argument for the **SCROLLING** command is either **ON** or **OFF.** This feature of the **HELP** command with *SPRITZ* makes the location of errors extremely easy.

SPRITZ Set-Up Commands

RAMFONS $AAAA/AAAA

For the most part, you will want your sprites to be made up of user-defined graphic characters, aliens, spacecraft etc. You tell *SPRITZ* that you want to use a character set or Font in RAM instead of ROM with the **RAMFONT** command. Its sole parameter is the address where the character set is stored. This can be expressed either in decimal, or hexadecimal preceded with a '$' character. *SPRITZ* also uses and interrupt to retain a character set, so when you generate an error message the computer will not go wild as it usually does!

Examples:
RAMFONT $3000
10 RAMFONT 49152

CBMFONT
However attractive a redefined character set is, it can be difficult to edit a program when all the colons appear as mushrooms or the numbers 0-9 as various sections of a centipede's body! To get your computer back to the normal Commodore font, just enter **CBMFONT.**

Examples:
CBMFONT
10CBMFONT

FONTCOPY 0/1
Most people find that they only want to redefine part of a character set as user defined graphics, and still want the usual alphanumeric characters. The answer is to copy the normal CBM character set down into RAM and then redefine the characters you want. The **FONTCOPY** command copies a character set into RAM. Either into UPPER case font **(FONTCOPY 0)** or the lower case font **(FONTCOPY 1).** The command must be preceded by a **RAMPONT** command to tell *SPRITZ* where to put the new character set.

Examples:
RAMFONT $3000:FONTCOPY 0
10 RAMFONT 49152:FONTCOPY 1

DEFINE Char, D0, D1, D2, D3, D4, D5, D6, D7

Once you have copied a standard font into RAM, you will probably want to redefine some of the characters to form graphics with which to build sprites or displays. Usually, this would be done using a series of DATA statements and POKES. These are replaced with one command in *SPRITZ,* **DEFINE.**

The **DEFINE** command takes nine parameters in the range 0-255. The first is the character number, and the 8 that follow are the data bytes which make up the character.

Note, the character number is not ASCII, as in CHR$(c), but a screen code. The relevant code for each character can be found on Page 192 of your computer manual.

See also the section in the SPRITZ SCRN function.

Example:
10 RAMFONT $300: FONTCOPY 0
20 DEFINE 0, 170, 85, 170, 85, 170, 85, 170, 85
30 PRINT "@ @ @ @ @ @ @ @ @ @"

HARDRVS and SOFTRVS

A character set can contain either 128 characters and use the **RVS ON/OFF** function, or 256 characters with no hardware reversing. If you need the extra characters, entering **SOFTRVS** does this, with reversing being handled by software if required. **HARDRVS** selects the fewer 128 characters, but with **RVS ON/OFF** being handled by hardware.

Examples:
HARDRVS: PRINT "ABCD [RVSON] ABCD"
SOFTRVS: PRINT "ABCD [RVSON] ABCD"

HIRES and MULTI
The Plus/4 computer has several modes, the most important of which are High-resolution and Multi-colour. The **HIRES** and **MULTI** commands switch between the two. **HIRES** mode is usually in operation. **MULTI** mode, which is used in quite a number of arcade games, halves the horizontal resolution but allows each pixel to be one of four different colours.

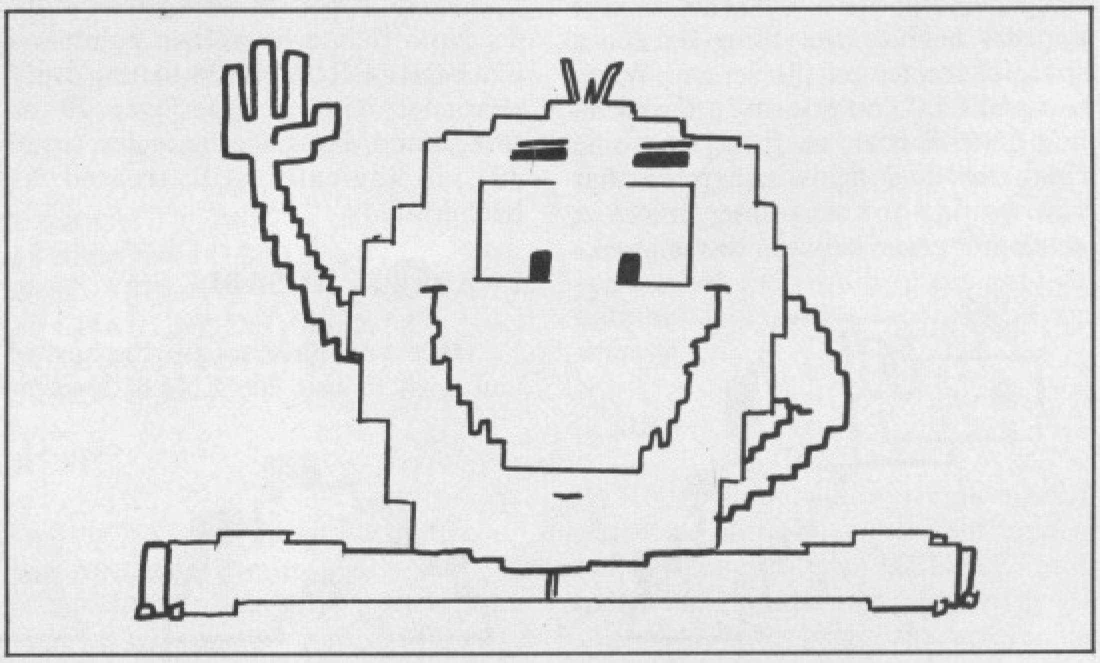
Examples:
HIRES: PRINT "[ORNG] SPRITZ"
MULTI: PRINT "[ORNG] SPRITZ"

SPRITZ Sprite Commands

SPRITE SP, CH0, CH1, CH2, CH3, C0, L0, C1, L1, C2, L2, C3, L3

Each sprite under *SPRITZ* control is made up of four characters displayed on the Plus/4 low-resolution screen. These characters are arranged in a square of 2*2 characters, and each character can be an individual colour. Reverse or normal characters can be used to make up a sprite, and each colour can be one of the Plus/4's full 121. The **SPRITE** command is used to tell *SPRITZ* which characters and colours are to be used to make up a sprite. The parameters it requires are:

SP – Sprite number (0-7)
CHO – Top left char code (0—255)
CH1 – Top right char code (0—255)
CH2 – Bottom left char code (0—255)
CH3 – Bottom left char code (0—255)
Cn – Colour for that quarter (1—16)
Ln – Luminance for that quarter (0—7)



As you can see, the characters are specified not as ASCII but as screen codes, as for the **DEFINE** command. The reason for this is that using ASCII, reverse characters are not evaluated. To specifiy a reverse character using the character code you simply add 128 to the original value. Again, the relevant values can be found on page 192 of your manual, also refer the *SPRITZ* **SCRN** function.

Colours are represented using the colour and luminance values that you would use in a COLOR command to represent all 121 colours. These are entered in the same order as the character codes for each quarter of the sprite. Each sprite is numbered 0-7 for each of the eight available.

Examples:
SPRITE 0, 1, 2, 3, 4, 3, 7, 3, 6, 3, 5, 3, 4

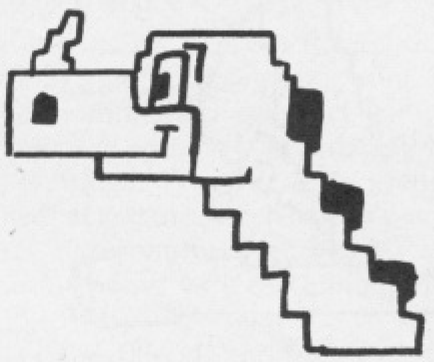
When *SPRITZ* is first used, each sprite is set up as characters 96-127 (the last in a character set), with each character being black. The characters in each sprite are arranged thus:-

	Character	Colours
SPRITE 0	96 97	1,0 1,0
	98 99	1,0 1,0
SPRITE 1	100 101	1,0 1,0
	102 103	1,0 1,0

and so on....

FOREGROUND CH and **MODE SP, OVER/UNDER/SELECT**

As mentioned before, each sprite can be displayed either above or behind foreground graphics, or with selective priority. If a sprite is **OVER** it appears on top of anything printed on the screen. If a sprite is **UNDER** then it appears behind everything except a space character on the screen. When using **SELECT**ive priority, a sprite can made to appear in front of some characters and below others so that you could, for example, make a helicopter move between tower blocks or weave in and out in a pattern. You can make each sprite behave in any one of the three ways, so you could have a helicopter moving between buildings, clouds moving behind, and a gunsight in front.



The **MODE** command is used to specify how a sprite is displayed on the screen. It takes two parameters: The first SP is the sprite number in the range of 0-7, and the second parameter should be one of **OVER, UNDER** or **SELECT** as explained above.

The **MODE** of a sprite should be chosen before a sprite is first **ENABLE**d.

When you first use *SPRITZ,* all sprites are set to **OVER.**

Examples:
FOR N=0 TO 7:MODE N, UNDER: NEXT N
10 MODE 0, SELECT

When using **SELECT** mode you have to tell *SPRITZ* which characters should be considered as foreground and which as background. The command to do this is **FOREGROUND.** Its single parameter in the range 0-255 is the character to be used as foreground. To clarify this, the examples below show the result of each value:

Examples:
FOREGROUND 128 – All reversed characters are foreground and all others background.

FOREGROUND 65 – Every character with a code of 65-225 is foreground and every other in the range 0-64 is background.

Note that even with a command like **FOREGROUND 30,** setting every character with a code over 29 as foreground, the space character, (code 32), is logically still treated as background.

ENABLE SP/DISABLE SP

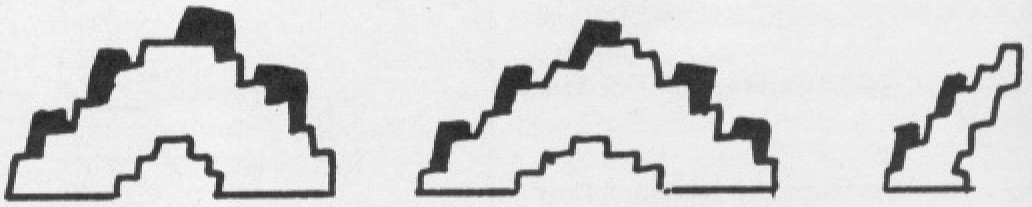
Once you have set up the sprites you wish to use, the **ENABLE** command is used to switch them on. The command takes only one parameter, the sprite number in the range 0-7. Once enabled, the sprite stays on the screen continuously. Even if you clear the screen, the sprite is reprinted in its original position. This means that you could use one routine to scroll a background and another to control the sprite, and the routines don't need to take any notice of each other!

Once you have finished using any sprites you can switch them off using the **DISABLE** command with the sprite number as its argument. Note that when using a large number of sprites in the Basic direct mode, there can be considerable losses in speed of keyboard auto-repeat as the computer is doing a lot more work than usual on its interrupt. Thus, it is a good idea to switch sprites off when leaving a program to improve the auto-repeat speed. The internal clock will inevitably run slightly slower than normal when *SPRITZ* is maintaining many sprites.

Examples:
ENABLE 1:ENABLE 2:DISABLE 4
10 FOR S=0 to 7:ENABLE S:NEXT

MOVE SP TO TX, TY

Obviously you need to be able to move sprites around the screen. The **MOVE** command is the primary way of doing this. The command takes three parameters: the sprite number **SP** in the range 0-7, and the coordinates to which the sprite should be moved. The destination coordinates should be seperated from the sprite number using **TO** as for the Commodore **DRAW** command. Coordinates should be separated using a comma like all other *SPRITZ* commands. The X-coordinate should be in the range 0-38 and the Y-coordinate in the range 0-23. When you use a **MOVE** command with that sprite enabled, *SPRITZ* automatically removes the sprite from the screen and reprints it in the new position leaving the screen intact. The **MOVE** command can also be used when a sprite is not enabled in order to move it to its initial



position. When you first use *SPRITZ*, the sprites are arranged in a row in the top left of the screen.

Examples:

X=10:Y=10:MOVE 1 TO X, Y: ENABLE 1

SHIFT SP SLEFT/SRIGHT/SUP/SDOWN and SHIFT SP,DIR

Usually you will want to move a sprite one character at a time, and the **SHIFT** command can be used to do just this. It will move any sprite one character Left, Right, Up or Down. If a sprite goes off an edge of the screen, it reappears at the opposite side. Moving off the screen to the right makes the sprite reappear on the left. The **SHIFT** command has two possible syntaxes. Both take their first parameter, the sprite number, in the range 0-7. Following the sprite number is the direction in which the sprite is to be moved. If the direction is expressed as a number, it should be preceded by a comma. The effect of each of the possible arguments are as follows:

NUMERIC	WORD	DIRECTION
0	SLEFT	LEFT
1	SRIGHT	RIGHT
2	SUP	UP
3	SDOWN	DOWN

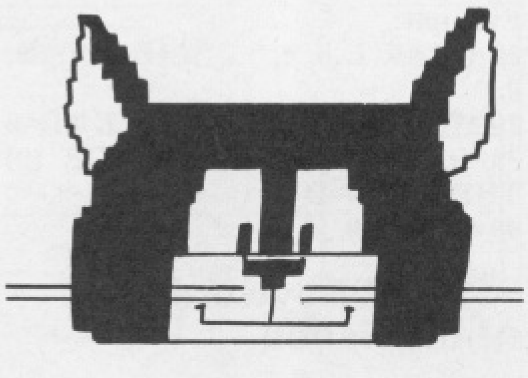
Note that when you specify the direction in English as a single word, the word should be preceded by 'S'. This is to avoid clashes with the BASIC functions LEFT$ and RIGHT$.

Examples:
ENABLE 0: DO: SHIFT 0 SPRIGHT: SHIFT 0 DOWN: LOOP
ENABNLE 0: DO : D = RND (1)*4: SHIFT 0,D: LOOP

SPRITZ UTILITY COMMANDS

SCROLLING ON/OFF

One of the problems implementing sprites using software is that whenever a program or entry in direct mode causes the screen to scroll up, the sprites will also scroll, leaving an image above them. Usually this will not be a problem when programming, but if you wish to print on the bottom line of the screen while sprites are enabled, it can be useful to disable the screen



scrolling effect. To do this just type **SCROLLING OFF** or to re-enable it, type **SCROLLING ON.**

When scrolling is disabled, if the cursor, is pushed off the bottom line of the screen, instead of scrolling the screen up, it just reappears at the top of the screen. The **SCROLLING** command is the equivalent of the **ESC 'M'** and **ESC 'L'** sequences.

Examples:

SCROLLING ON: ENABLE 0: CHAR1, 39, 24, "*"

SCREEN SUP/SDOWN

Sometimes you may want to scroll the screen up or down but leave the sprites you have enabled intact. The **SCREEN** command will do just this.

SCREEN works by first removing all the sprites from the screen, scrolling the screen either up or down, and then reprinting all the sprites previously enabled. When using many sprites this inevitably causes some screen flicker so it is not really recommended for rapid use. However, it can be very useful when editing programs or implementing an asteroids type effect. **SCREEN SUP** scrolls the screen up and **SCREEN SDOWN** scrolls it down. Each scrolling it one line in each direction. Note that if you have a window specified, the **SCREEN** command will scroll the window only.

Example:
10 MOVE 0 TO 20,12
20 ENABLE 0
30 CHAR1,RND(1)*40, 0, "*"
40 SCREEN SDOWN
50 GOTO 30

RESET

If you do something like enter an incorrect address in a **RAMFONT** command, or leave all your sprites enabled when entering direct mode to edit a program, it can be hard to tell what's going on when the character set is corrupted. If you get into such a situation entering **RESET** will reset all *SPRITZ'S* varables to their default values.

The command can also be used at the start of a program to make sure that all the system variables contain the default values. These default settings are shown below:-

MODE	: HIRES
FONT	: CBMFONT (Upper case)
REVERSE	: SOFTRVS
SPRITES	: DISABLEd

Examples:

10 RESET:SCNCLR:ENABLE 0
RESET:SCNCLR

SPRITZ

As *SPRITZ* adds 30 new keywords to the Basic operating system, it can be a little difficult to remember all of them. If you cannot remember a command or keyword, typing *SPRITZ* will display a list of them on the sreen. It will automatically configure the list width to the size of the current window.

Example:
SPRITZ

10 SCNCLR:SPRITZ

SPRITZ User Function

As well as the 19 commands *SPRITZ* adds to Basic, *SPRITZ* also provides you with four new functions. These make the setup and control of sprites easier. These are used just like Basic functions as an argument of another command. For example:- **PRINT SCRN ("A")** will print the screen or character code value of the ASCII "A" character. Equally **C%=SCRN("A")** will assign this value to the variable C%. As you can see, these functions are used as the argument for another command, not as a command by themselves.

SCRN ("CHR")

SCRN is used to convert an ASCII character into its equivalent screen code used in the **DEFINE** and **SPRITE** commands. As with all functions, the single parameter is

enclosed within brackets and, as the argument is a string, it should also be enclosed within inverted commas. The string should only be one character long, but, if the string you specifiy is longer, in the same manner as the Basic **ASC** function, only the leftmost character is considered. You can also use functions from within other functions as long as they yield the correct type of parameter.

Examples:

DEFINE SCRN ("@"), 170, 85, 170, 85, 170, 85, 170, 85
10 S=SCRN (CHR$(64)
20 PRINT S

XPOS (SP) and **YPOS (SP)**

The **XPOS** and **YPOS** functions are used to find the position of any sprite.

The one parameter they take is the sprite number, which should be in the range 0-7. The functions should only really be used when the sprite you are finding the position of is enabled. The values returned are in the ranges of 0-38 and 0-23 for the X and Y-coordinates respectively.

Examples:

ENABLE 0:MOVE 0 TO XPOS (0)+1, YPOS (0)+1
10 PRINT "Position of Sprite 4: ";XPOS (0);",";YPOS (0)

COLLIDE (SP)

COLLIDE is an important part of the *SPRITZ* system. It tells you whether or not a sprite (SP) has collided with a character which is foreground. It returns a zero for no collision or a one for a collision. Collide can be used with the **IF** command like any normal function. What constitutes a collision is for any of the characters in the 2*2 square the sprite occupies, to be a non-space character, greater or equal to the **FOREGROUND** setting. Thus the two setups below are respectively no collision and a collision.

Foreground value 1
Sprite 0 at (10,10)

Contents:

32 0 - COLLIDE (0)=0
0 32

1 32 -COLLIDE (0)=1
32 32

Example:
10 CHAR 1, 0, 0, ">":CHAR 1, 39, 0, " "
20 MOVE 0 TO 20, 0:ENABLE 0:D=0
30 SHIFT 0, D:IF COLLIDE (0) THEN D=1—D
40 GOTO 30

SPRITZ Keyword Abbreviation

That brings an end to the discussion of each of the *SPRITZ* commands and keywords, however, to cut down on typing you can use a simple abbreviation for each keyword. The full and abbreviated forms of each *SPRITZ* keyword are shown below:

FULL KEYWORD	ABBREVIATION
CBMFONT	C (Shift-B)
COLLIDE	C (Shift-D)
DEFINE	D (Shift-E)
DISABLE	D (Shift-I)
ENABLE	E (Shift-N)
FONTCOPY	FO (Shift-N)
FOREGROUND	F (Shift-O)
HARDRVS	H (Shift-A)
HIRES	H (Shift-I)
MODE	M (Shift-O)
MOVE	M (Shift-V)
MULTI	M (Shift-U)
OVER	O (Shift-V)
RAMFONT	R (Shift-A)
RESET	R (Shift-E)
SCREEN	S (Shift-C)
SCRN	SCRN
SCROLLING	SCR (Shift-O)
SDOWN	S (Shift-D)
SELECT	S (Shift-E)
SHIFT	S (Shift-H)
SLEFT	S (Shift-L)
SOFTRVS	S (Shift-O)
SPRITE	S (Shift-P)
SPRITZ	SPRITZ
SRIGHT	S (Shift-R)
SUP	SUP
UNDER	U (Shift-N)
XPOS	X (Shift-P)
YPOS	Y (Shift-P)

As you can see, using abbreviations can save you up to seven characters of typing per command, which for those less experienced on the keyboard, can be quite considerable.

SPRITZ Sprite - Editor Program

As well as the *SPRITZ* Basic commands, I have provided a full-featured Sprite Editor which can be used to create colour, hires Sprites for *SPRITZ* with the minimum of effort. As the program is fully cursor controlled, it is not neccesary to use any numbers at all to define a sprite.

The Screen Display

When you run the Sprite Editor program you will see that the screen is divided into seven squares or windows. These windows are used as follows:

The **Title Window** at the head of the screen simply displays the Sprite—Editor heading.

The **Edit Window** on the left of the screen is where all the action happens. In it is displayed a full colour, enlarged version of the sprite currently being edited. In the Edit Window you can move the cursor and change the status of pixels and colours.

When you first run the Sprite-Editor it will contain a display of sprite 0 and a cross wire cursor in the top left of the window.

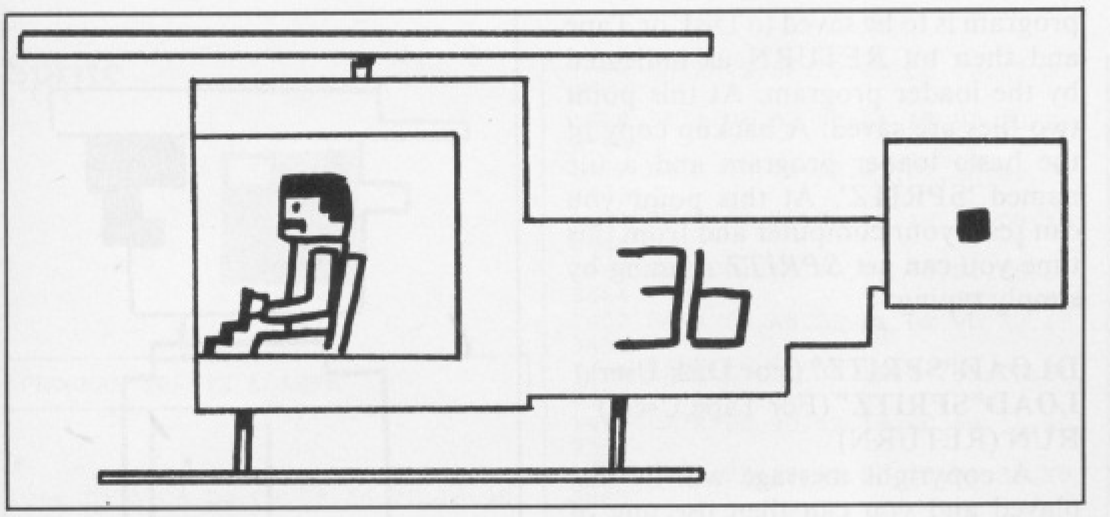
Next to the edit window are two windows which contain a normal size picture of the current sprite. The windows look identical but the top one shows the current sprite in colour and the lower one in monochrome.

On the centre-right of the screen is the **Dialogue Window** which for most of the time displays a reminder of the control keys the Sprite Editor program uses. Whenever you are using a function such as saving a set of sprites or changing colours, all the computers output and human input is displayed in this window.

In the bottom-right corner of the screen is a window which displays the eight sprites which are currently in memory, accompanied by their equivalent number. These sprites are displayed in colour as in the top display window.

The final window, the **Status Window** is located beneath the two display windows. On the left is displayed the number of the sprite which is being edited, and on the right is the current editing mode.

When first run, these will be # 0 and "+".



The Control Keys

The most important keys the Sprite Editor uses are the cursor control keys. If you press these you can see the cross wire cursor in the Edit window move around the window.

If you move the cursor over a set pixel then it changes to a white cross on a coloured square, if it is on a reset (white) pixel then it appears coloured on a white background. In this way the cursor is always visible and the status of the pixel it covers is still displayed. The Sprite-Editor will prevent you from trying to move outside the Edit Window.

Individual pixels of a sprite can be changed by using the 'A' and 'Z' keys to Set and Reset the pixel under the cursor. Any changes you make to a sprite are displayed in colour in the top display window and the sprite window, and in the monochrome in the lower display window.

As well as changing the state of pixels individually, you can make the cursor leave a trail of either Set (coloured) pixels or Reset (white) pixels as you move it around the edit window. To make it leave a Set trail press F1, or to make it leave a Reset trail press F2. These are the equivalents of drawing or erasing. If you only want to change pixels individually using 'A' and 'Z', then you can press F3 to do so. The current drawing mode is shown in the status window. A '+' indicates the draw or set mode, a '-' indicates the Erase or Reset mode, and a '.' indicates that pixels will be unchanged when you move the cursor over them – the Over Mode.

One of the features the Sprite-Editor program offers which is unique to *SPRITZ* is the colour function.

As explained before, a sprite can have a different colour for each of its four single character quarters. By pressing 'C' you can change the colour of the quarter-Sprite in which the cursor is currently located. When you press 'C' the program will clear the dialogue window and prompt for Colour (1-16) and Luminance (0-7). When you enter these, the change in colour will be displayed in the Edit, Display and Sprite windows. The cursor will them draw in the new colour selected.

PROGRAM:SPRITZ LOADER

```
10 REM ***********************
20 REM *                     *
30 REM * SPRITZ BASIC LOADER *
40 REM *                     *
50 REM ***********************
60 REM
70 GRAPHIC 1:GRAPHIC 0
80 PRINT CHR$(27)"RSPRITZ BASIC LO
ADER PROGRAM"
90 PRINT"(DOWN)WRITTEN JANUARY 198
9 BY M.R EVERINGHAM"
100 PRINT"(DOWN)__________________
____________________"
110 AD%=4097:FOR LI=1000 TO 3750 S
TEP 10
120 PRINT"(HOME)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)STORING DATA LINE"LI
130 CH%=0:FOR BY=0 TO 7:READ DA$
140 DA%=DEC(DA$):CH%=CH%+DA%
150 IF DA%<0 OR DA%>255 THEN PRINT
"number too large in line"li:end
160 POKE AD%+BY,DA%:NEXT BY:READ V
R$
170 VR%=DEC(VR$):IF CH%<>VR% THEN
PRINT"(DOWN)CHECKSUM ERROR IN LINE
"LI:END
180 AD%=AD%+8:NEXT LI
190 PRINT"(DOWN)SPRITZ DATA 100% C
ORRECT"
200 PRINT"(DOWN)DO YOU WANT TO USE
 [T]APE OR [D]ISK?"
210 DO:GET KE$:LOOP UNTIL INSTR("T
D",KE$)
220 IF KE$="T"THEN POKE 208,1:ELSE
 POKE 208,8
230 PRINT"(DOWN)INSERT SPRITZ ";:I
F KE$="T"THEN PRINT"TAPE";:ELSE PR
INT"DISK";
240 PRINT" AND PRESS RETURN"
250 DO:GET KE$:LOOP UNTIL KE$=CHR$
(13)
260 FOR BY=0 TO 3:POKE 209+BY,PEEK
(43+BY):NEXT BY
270 PRINT"(DOWN)SAVING SPRITZ BASI
C LOADER..."
280 SAVE"SPRITZ LOADER",PEEK(208)
290 PRINT"(DOWN)SAVING SPRITZ SYST
EM PROGRAM..."
300 POKE 43,1:POKE 44,16:POKE 45,1
59:POKE 46,24
310 SAVE"SPRITZ",PEEK(208)
```

If you want to start with a clean canvas so to speak, then pressing the 'CLR/HOME' key will clear the Edit window leaving you with an empty black sprite. Care should be taken using this function as you can not then recover your handiwork!

All of *SPRITZ's* eight sprites can be edited. You can change the sprite to be edited by pressing the 'E' key. The dialogue window will then clear and you can enter the sprite in the range 0-7. The new number is displayed in the Status window and the new sprite is drawn in the Edit and Display windows. The Sprite can then be edited just like any other.

When you are happy with your sprites you can save them onto disk or tape by pressing 'S'. The dialogue window will prompt you for the save device and you should press 'D' for the Disk or 'T' for Tape. The name under which you wish your collection of eight sprites to be saved should then be entered. The file-name should be no longer than ten characters as *SPRITZ* adds a five character extension of its own.

You can reload sets of sprites previously saved from the Sprite-Editor by hitting the 'L' key. The program will prompt for device and file-name in exactly the same way as for saving sprites. The sprites will then be reloaded for further editing.

Finally, when you have finished using the Sprite-Editor program, you can get out of it by pressing 'ESC' which will return you to Basic and reset the *SPRITZ* system variables to their default settings.

Changing the Sprite-Editor Font Address

When you first use the Sprite-Editor program, it is set up for a character set at $F800 – the highest possible place on a Plus/4 or 64K C16. If you want to change this address, for example, if you only have a 32K C16, then all you have to do is change the **RAMFONT** command in line 90 and the **ADDRESS** declaration in line 100 of the program. Care should be taken not to set the address lower than the end of the Sprite—Editor program if you have not saved a backup copy.

Using Sprites in your own programs

It is not much use designing a set of sprites if you cannot then use them in your own programs under the control of *SPRITZ*. Luckily, this is easy to do. The lines displayed below should be added to the start of your program to load in the sprite character set and data.

10 IFL = 0 THENL= 1: LOAD"name. FONT",(dev), 1
20 IFL = 1 THEN L = 2: LOAD" name.SPRT",(dev),1
30 ADDRESS = (ADDRESS)
40 RAMFONT AD
50 POKE55,0:POKE56,AD/256:CLR

You should insert the file-name given to your collection of sprites in place of 'name', (dev) should be replaced by 1 for tape users or 8 for disk users. (ADDRESS) should be replaced with the address at which your sprite character set is stored. This can be expressed in decimal, or in hex using DEC("AAAA") where "AAAA" is the hexadecimal address of the character set.

It must be stressed that this section of program should be used at the beginning of a program and will only work in this position because it is necessary to clear (or CLR) all Basic variables after loading a section of data into RAM.

When the program section shown above has been run, your sprites can be displayed and moved simply by **ENABLE**ing the sprites and then using the normal *SPRITZ* commands. There is no need to execute any further **SPRITE** command as *SPRITZ* sprite data as well as character set data is loaded into RAM, thus simulating the effect of a series of **DEFINE** and **SPRITE** commands.

Getting SPRITZ Up and Running

The BASIC Loader Program

The Basic Loader Program is used to install the *SPRITZ* machine-code program. It should be entered and run in the normal way. The program gives its own error messages to help you locate any errors you may have entered in the data section. Once the program has been entered correctly, you should press 'D' or 'T' to choose whether the program is to be saved to Disk or Tape and then hit RETURN as indicated by the loader program. At this point two files are saved: A backup copy of the basic loader program and a file named 'SPRITZ'. At this point you can reset your computer and from this time you can get *SPRITZ* running by simply typing:-

DLOAD"SPRITZ" (For Disk Users)
LOAD"SPRITZ" (For Tape Users)
RUN (RETURN)

A copyright message will be displayed and you can then use any of the *SPRITZ* commands and functions either in a program or in Basic direct mode.

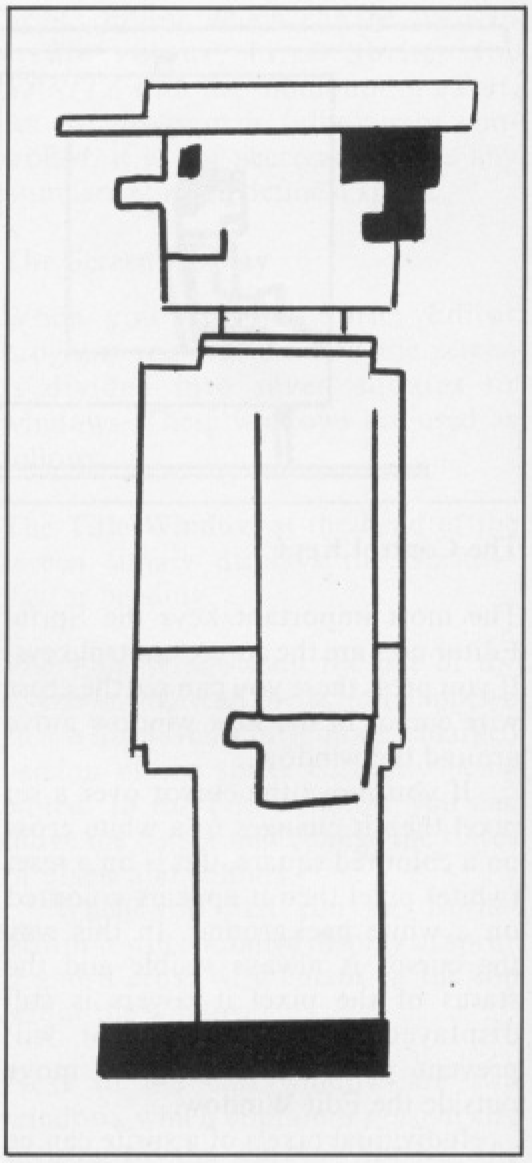
Demonstration Program

I have included a Demonstration program to display *SPRITZ*'s functions working to the limit. The program controls all eight colour sprites independantly and simultaneously while playing a section of J.S. Bach's 2-part Invention in D-Minor! – quite a feat for a humble Plus/4 program written in Basic!

To use the demo program you should first load the *SPRITZ* system program. You can then save the demonstration program using the procedure as follows:-

```
PROGRAM:SPRITZ LOADER

320 POKE 43,PEEK(209):POKE 44,PEEK
(210):POKE 45,PEEK(211):POKE 46,PE
EK(212)
330 PRINT"(DOWN)SAVING COMPLETE -
RESET MACHINE"
340 END
910 REM
920 REM **************************
***
930 REM *
  *
940 REM * MACHINE-CODE DATA SECTIO
N *
950 REM *
  *
960 REM *    (START AT LINE 1000)
  *
970 REM *
  *
980 REM **************************
***
990 REM
1000 DATA 0E,10,00,00,9E,20,34,31,
0141
1010 DATA 31,32,3A,A2,00,00,00,4C,
018B
1020 DATA B0,10,A9,70,A0,16,85,22,
0336
1030 DATA 84,23,A0,00,84,0B,88,C8,
0326
1040 DATA 20,A5,04,38,F1,22,F0,F7,
03FB
1050 DATA C9,80,F0,22,B1,22,30,03,
0361
```



DSAVE"SPRITZ DEMO"
(For Disk users)
SAVE"SPRITZ DEMO"
(For Tape users)

Before running the Demo program you should first load the *SPRITZ* system program.

Sprite-Editor Program

I have already discussed the actual use of the *SPRITZ* Sprite Editor, however you can save a copy of the program as shown below:

DSAVE "SPRITE EDITOR"
(For Disk users)
SAVE"SPRITE EDIOTR"
(For Tape users)

As with the Demo program, you should first load the *SPRITZ* system before running the Sprite-Editor.

Well there we are. Next time your snooty C64 owning friends are putting your Plus/4 computer to ridicule, all you have to do is load *SPRITZ*, run the demo and watch the smile fade from their faces!!!!

Sprite

PROGRAM:SPRITZ LOADER

```
1060 DATA C8,D0,F9,C8,E6,0B,18,98,
04FA
1070 DATA 65,22,85,22,90,02,E6,23,
02C9
1080 DATA 18,A0,00,B1,22,D0,D9,38,
036C
1090 DATA 20,79,04,4C,6A,89,05,0B,
01EC
1100 DATA C8,4C,D4,89,AA,A0,70,84,
04AF
1110 DATA 22,A0,16,84,23,4C,9E,8B,
02F4
1120 DATA C9,80,90,14,C9,93,B0,10,
0409
1130 DATA 38,E9,80,0A,A8,B9,1F,17,
0342
1140 DATA 48,B9,1E,17,48,4C,73,04,
0241
1150 DATA 4C,A1,94,A9,00,85,0D,20,
02DC
1160 DATA 73,04,C9,FE,F0,06,20,79,
03CD
1170 DATA 04,4C,1E,94,20,73,04,C9,
0262
1180 DATA 93,B0,03,4C,A1,94,C9,97,
0427
1190 DATA B0,F9,38,E9,80,0A,A8,B9,
04B5
1200 DATA 1E,17,85,55,B9,1F,17,85,
0283
1210 DATA 56,20,54,00,4C,17,93,20,
01E0
1220 DATA 48,DE,A9,BE,A0,17,20,88,
03EC
1230 DATA 90,A9,7C,A0,10,8D,0A,03,
02FF
1240 DATA 8C,0B,03,A9,13,A0,10,8D,
0293
1250 DATA 0C,03,8C,0D,03,A9,55,A0,
0249
1260 DATA 10,8D,0E,03,8C,0F,03,A9,
01F5
1270 DATA 61,A0,10,8D,10,03,8C,11,
024E
1280 DATA 03,A9,15,A0,12,8D,02,03,
0205
1290 DATA 8C,03,03,A9,00,8D,9F,18,
027F
1300 DATA A9,A0,A0,18,85,2B,84,2C,
0361
1310 DATA 78,A9,9A,A0,11,8D,14,03,
0310
1320 DATA 8C,15,03,58,60,A5,D6,F0,
03C7
1330 DATA 05,20,6A,11,C6,D2,A6,D3,
03B1
1340 DATA B1,D0,C9,20,D0,04,A9,00,
03E7
1350 DATA F0,1E,CD,9D,18,B0,04,A9,
03ED
1360 DATA 01,D0,15,A5,D6,F0,0F,86,
03E6
1370 DATA D4,A6,D5,AD,9C,18,1D,4C,
0419
1380 DATA 17,8D,9C,18,A6,D4,A9,02,
037D
1390 DATA E0,00,F0,10,E0,01,D0,06,
0397
1400 DATA C9,00,F0,08,D0,20,C9,02,
037C
1410 DATA D0,02,F0,1A,A6,D2,BD,F3,
0504
1420 DATA 17,91,D0,A5,D1,38,E9,04,
0413
1430 DATA 85,D1,BD,13,18,91,D0,A5,
0444
1440 DATA D1,18,69,04,85,D1,E6,D2,
0464
1450 DATA 60,A6,D2,B1,D0,9D,73,18,
0481
1460 DATA A5,D1,38,E9,04,85,D1,B1,
04A2
1470 DATA D0,9D,53,18,4C,60,11,BD,
0352
1480 DATA 73,18,91,D0,A5,D1,38,E9,
0483
1490 DATA 04,85,D1,BD,53,18,91,D0,
03E3
1500 DATA A5,D1,18,69,04,85,D1,E8,
0439
1510 DATA 60,48,8A,48,98,48,A2,00,
02FC
1520 DATA 86,D5,AD,9B,18,3D,4C,17,
035B
1530 DATA F0,1B,8A,0A,0A,AA,BD,33,
0343
1540 DATA 18,DD,35,18,D0,28,BD,34,
032B
1550 DATA 18,DD,36,18,D0,20,A9,00,
02DC
1560 DATA 85,D6,20,4A,14,E6,D5,A6,
043A
1570 DATA D5,E0,08,D0,D5,AD,12,FF,
0520
1580 DATA 2D,9E,18,8D,12,FF,68,A8,
0391
1590 DATA 68,AA,68,4C,0E,CE,20,A7,
0369
1600 DATA 14,A6,D5,BD,4C,17,49,FF,
03F7
1610 DATA 2D,9C,18,8D,9C,18,8A,0A,
02B6
1620 DATA 0A,AA,BD,35,18,9D,33,18,
02A6
1630 DATA BD,36,18,9D,34,18,A9,FF,
039C
1640 DATA 85,D6,20,4A,14,4C,C6,11,
02FC
1650 DATA 20,73,04,20,85,94,20,17,
0207
1660 DATA 93,4C,87,9D,20,F9,10,4C,
0378
1670 DATA 12,87,8A,0A,0A,A8,B9,33,
02CB
1680 DATA 18,D9,35,18,D0,F8,B9,34,
03F3
1690 DATA 18,D9,36,18,D0,F8,60,20,
0387
1700 DATA 5F,12,20,71,12,20,1D,13,
0164
1710 DATA 20,58,13,20,46,12,A9,00,
01AC
1720 DATA 8D,9B,18,58,60,78,A2,00,
0312
1730 DATA 86,D5,AD,9B,18,3D,4C,17,
035B
1740 DATA F0,03,20,A7,14,E6,D5,A6,
042F
1750 DATA D5,E0,08,D0,ED,60,AD,07,
048E
1760 DATA FF,29,EF,8D,07,FF,60,AD,
04B7
1770 DATA 07,FF,09,10,8D,07,FF,60,
0312
1780 DATA AD,12,FF,09,04,8D,12,FF,
0369
1790 DATA A9,D0,8D,13,FF,A9,FF,8D,
054D
1800 DATA 9E,18,60,C9,24,F0,1B,20,
032E
1810 DATA E1,9D,C0,30,F0,03,4C,1C,
0399
1820 DATA 99,8D,13,FF,AD,12,FF,29,
041F
1830 DATA FB,8D,12,FF,A9,FB,8D,9E,
0568
1840 DATA 18,60,20,73,04,20,D0,12,
0211
1850 DATA 0A,0A,0A,0A,AA,20,73,04,
0169
1860 DATA 20,D0,12,85,D7,8A,05,D7,
03C4
1870 DATA 8D,13,FF,20,73,04,C9,30,
032F
1880 DATA D0,CC,20,73,04,C9,30,D0,
03FC
1890 DATA C5,20,73,04,4C,95,12,C9,
0318
1900 DATA 47,90,03,4C,A1,94,C9,41,
0365
1910 DATA 90,03,E9,37,60,C9,3A,B0,
03C6
1920 DATA F2,C9,30,90,EE,E9,30,60,
04E2
1930 DATA 20,84,9D,E0,02,90,03,4C,
0302
1940 DATA 1C,99,A9,D0,E0,00,F0,02,
0400
1950 DATA A9,D4,85,63,A9,00,85,62,
03F5
1960 DATA 85,64,AD,13,FF,29,FC,85,
0452
1970 DATA 65,A2,04,A0,00,B1,62,91,
034F
1980 DATA 64,C8,D0,F9,E6,63,E6,65,
0589
1990 DATA CA,D0,F2,60,AD,07,FF,29,
04C8
2000 DATA 7F,8D,07,FF,60,AD,07,FF
0425
2010 DATA 09,80,8D,07,FF,60,C9,91
03D6
2020 DATA F0,22,C9,4F,F0,03,4C,A1
040A
2030 DATA 94,20,73,04,C9,46,D0,F6
0400
2040 DATA 20,73,04,C9,46,D0,EF,20
0385
2050 DATA 73,04,A9,1B,20,4B,EC,A9
033B
2060 DATA 4D,4C,4B,EC,20,73,04,A9
0310
2070 DATA 1B,20,4B,EC,A9,4C,4C,4B
02FE
2080 DATA EC,20,84,9D,8E,9D,18,60
03D0
2090 DATA 20,84,9D,86,14,A9,00,85
0309
2100 DATA 15,85,D7,06,14,26,15,06
01CC
2110 DATA 14,26,15,06,14,26,15,AD
0151
2120 DATA 13,FF,29,FC,18,65,15,85
034E
2130 DATA 15,20,91,94,20,84,9D,8A,
0325
2140 DATA A4,D7,91,14,C8,84,D7,C0,
0503
2150 DATA 08,D0,EE,60,20,84,9D,E0,
0447
2160 DATA 08,90,03,4C,1C,99,20,91,
024D
2170 DATA 94,C9,FE,F0,03,4C,A1,94,
04CF
2180 DATA 20,73,04,C9,9A,B0,F6,C9,
0469
2190 DATA 97,90,F2,E9,97,9D,93,18,
04E1
2200 DATA 4C,73,04,20,84,9D,E0,08,
02EC
2210 DATA 90,03,4C,1C,99,8A,0A,0A,
0232
2220 DATA 85,D7,85,15,A9,04,85,14,
033C
2230 DATA 20,91,94,20,84,9D,8A,A4,
03B4
2240 DATA D7,99,F3,17,E6,D7,C6,14,
0511
```

```
2250 DATA D0,EE,A9,04,85,14,20,9
1,03B5
2260 DATA 94,20,84,9D,CA,E0,10,B
0,043F
2270 DATA D1,86,D7,20,91,94,20,8
4,0417
2280 DATA 9D,E0,08,B0,C5,8A,0A,0
A,0398
2290 DATA 0A,0A,05,D7,A4,15,99,1
3,0255
2300 DATA 18,E6,15,C6,14,D0,D7,6
0,03F4
2310 DATA 20,84,9D,E0,08,90,03,4
C,0308
2320 DATA 1C,99,78,8A,0A,0A,A8,B
9,032C
2330 DATA 35,18,99,33,18,B9,36,1
8,0238
2340 DATA 99,34,18,86,D5,A9,FF,8
5,046D
2350 DATA D6,20,4A,14,A6,D5,BD,4
C,03D8
2360 DATA 17,0D,9B,18,8D,9B,18,5
8,026F
2370 DATA 60,A6,D5,BD,93,18,85,D
3,049B
2380 DATA 8A,0A,0A,AA,86,D2,BD,3
4,0391
2390 DATA 18,0A,A8,B9,54,17,85,D
0,0343
2400 DATA B9,55,17,85,D1,BD,33,1
8,0383
2410 DATA 18,65,D0,85,D0,90,02,E
6,041A
2420 DATA D1,A0,00,20,06,11,C8,2
0,0290
2430 DATA 06,11,98,18,69,27,A8,2
0,021F
2440 DATA 06,11,C8,4C,06,11,20,8
4,01E6
2450 DATA 9D,E0,08,90,03,4C,1C,9
9,0319
2460 DATA 20,1B,12,BD,4C,17,49,F
F,02B5
2470 DATA 2D,9B,18,8D,9B,18,86,D
5,0378
2480 DATA 78,20,A7,14,58,60,A5,D
5,0385
2490 DATA 0A,0A,AA,BD,34,18,0A,A
8,0279
2500 DATA B9,54,17,85,D0,B9,55,1
7,039E
2510 DATA 85,D1,BD,33,18,18,65,D
0,03AB
2520 DATA 85,D0,90,02,E6,D1,A0,0
0,043E
2530 DATA 20,80,11,C8,20,80,11,9
8,02C2
2540 DATA 18,69,27,A8,20,80,11,C
8,02C9
2550 DATA 4C,80,11,20,84,9D,E0,0
8,0306
2560 DATA 90,03,4C,1C,99,8A,0A,0
A,0232
2570 DATA 85,D7,20,79,04,C9,A4,F
0,0456
2580 DATA 03,4C,A1,94,20,81,9D,E
0,03A2
2590 DATA 27,B0,E7,8A,A6,D7,9D,3
5,0497
2600 DATA 18,20,91,94,20,84,9D,E
0,037E
2610 DATA 18,B0,D7,8A,A6,D7,9D,3
6,0479
2620 DATA 18,60,20,84,9D,E0,08,9
0,0331
2630 DATA 03,4C,1C,99,8A,0A,0A,8
5,0227
2640 DATA D7,20,79,04,C9,FE,F0,1
1,043C
2650 DATA C9,2C,D0,0A,20,81,9D,E
0,03ED
2660 DATA 04,90,17,4C,1C,99,4C,A
1,0299
2670 DATA 94,20,73,04,C9,9E,B0,F
6,0438
2680 DATA C9,9A,90,F2,E9,9A,AA,2
0,0532
2690 DATA 73,04,8A,A6,D7,A8,F0,1
7,042D
2700 DATA 88,F0,1F,88,F0,2C,FE,3
6,046F
2710 DATA 18,BD,36,18,C9,18,F0,0
1,02F5
2720 DATA 60,A9,00,9D,36,18,60,D
E,0332
2730 DATA 35,18,10,F4,A9,26,9D,3
5,02F2
2740 DATA 18,60,FE,35,18,BD,35,1
8,02CD
2750 DATA C9,27,D0,E4,A9,00,9D,3
5,041F
2760 DATA 18,60,DE,36,18,10,D9,A
9,0336
2770 DATA 17,9D,36,18,60,C9,FE,D
0,03F9
2780 DATA 07,20,73,04,C9,9F,90,0
3,0299
2790 DATA 4C,A1,94,C9,9C,90,F9,E
9,0558
2800 DATA 46,85,14,20,73,04,20,4
6,01DC
2810 DATA 12,A9,1B,20,4B,EC,A5,1
4,02E6
2820 DATA 20,4B,EC,A2,00,86,D5,A
9,03FD
2830 DATA FF,85,D6,AD,9B,18,3D,4
C,0443
2840 DATA 17,F0,03,20,4A,14,E6,D
5,0343
2850 DATA A6,D5,E0,08,D0,ED,58,6
0,04D8
2860 DATA A9,86,A0,17,20,88,90,A
0,03BE
2870 DATA 00,B9,70,16,F0,21,48,2
9,02C1
2880 DATA 7F,20,4B,EC,68,C8,29,8
0,03AF
2890 DATA F0,EF,AD,E8,07,4A,C5,C
A,0554
2900 DATA 90,05,85,CA,4C,DA,15,A
9,03C8
2910 DATA 0D,20,4B,EC,4C,DA,15,6
0,02FF
2920 DATA 20,09,12,E0,08,90,03,4
C,0202
2930 DATA 1C,99,8A,0A,0A,AA,BD,3
3,02ED
2940 DATA 18,A8,4C,81,9A,20,09,1
2,0262
2950 DATA E0,08,90,03,4C,1C,99,8
A,0306
2960 DATA 0A,0A,AA,BD,34,18,A8,4
C,02BB
2970 DATA 81,9A,20,09,12,E0,08,9
0,02CE
2980 DATA 03,4C,1C,99,20,1B,12,A
D,01FE
2990 DATA 9C,18,3D,4C,17,A8,F0,0
2,02EE
3000 DATA A0,01,4C,81,9A,20,73,0
4,029F
3010 DATA 20,85,94,20,67,9D,A0,0
0,02FD
3020 DATA 20,B0,04,10,0C,29,7F,C
9,0261
3030 DATA 7F,D0,02,A9,5E,09,40,D
0,0371
3040 DATA 0A,C9,60,90,04,29,DF,D
0,039F
3050 DATA 02,29,3F,A8,4C,81,9A,4
6,02BF
3060 DATA 4F,52,45,47,52,4F,55,4
E,0271
3070 DATA C4,53,50,52,49,54,C5,4
D,0368
3080 DATA 4F,44,C5,45,4E,41,42,4
C,02BA
3090 DATA C5,44,49,53,41,42,4C,C
5,0339
3100 DATA 4D,4F,56,C5,53,48,49,4
6,02E1
3110 DATA D4,53,43,52,45,45,CE,5
2,0366
3120 DATA 45,53,45,D4,53,43,52,4
F,02E8
3130 DATA 4C,4C,49,4E,C7,46,4F,4
E,02D9
3140 DATA 54,43,4F,50,D9,44,45,4
6,02DE
3150 DATA 49,4E,C5,48,49,52,45,D
3,0357
3160 DATA 4D,55,4C,54,C9,43,42,4
D,02DD
3170 DATA 46,4F,4E,D4,52,41,4D,4
6,02DD
3180 DATA 4F,4E,D4,48,41,52,44,5
2,02E2
3190 DATA 56,D3,53,4F,46,54,52,5
6,030D
3200 DATA D3,53,50,52,49,54,DA,5
8,0397
3210 DATA 50,4F,D3,59,50,4F,D3,4
3,0380
3220 DATA 4F,4C,4C,49,44,C5,53,4
3,02CF
3230 DATA 52,CE,4F,56,45,D2,55,4
E,037F
3240 DATA 44,45,D2,53,45,4C,45,4
3,02C7
3250 DATA D4,53,4C,45,46,D4,53,5
2,0377
3260 DATA 49,47,48,D4,53,55,D0,5
3,0377
3270 DATA 44,4F,57,CE,00,61,13,C
3,02EF
3280 DATA 13,9C,13,18,14,86,14,D
B,0263
3290 DATA 14,12,15,8D,15,2F,12,2
E,014C
3300 DATA 13,E8,12,68,13,5E,12,6
7,025F
3310 DATA 12,70,12,83,12,1C,13,2
5,017D
3320 DATA 13,D0,15,01,16,16,16,2
B,0166
3330 DATA 16,46,16,01,02,04,08,1
0,0091
3340 DATA 20,40,80,00,0C,28,0C,5
0,0170
3350 DATA 0C,78,0C,A0,0C,C8,0C,F
0,0300
3360 DATA 0C,18,0D,40,0D,68,0D,9
0,0183
3370 DATA 0D,B8,0D,E0,0D,08,0E,3
0,0205
3380 DATA 0E,58,0E,80,0E,A8,0E,D
0,0288
3390 DATA 0E,F8,0E,20,0F,48,0F,7
0,020A
3400 DATA 0F,98,0F,C0,0F,0D,53,5
0,0235
3410 DATA 52,49,54,5A,20,43,4F,4
D,0248
3420 DATA 4D,41,4E,44,53,20,26,2
0,01D9
3430 DATA 4B,45,59,57,4F,52,44,5
3,0278
3440 DATA 0D,A3,A3,A3,A3,A3,A3,A
3,0482
3450 DATA A3,A3,A3,A3,A3,A3,A3,A
3,0518
3460 DATA A3,A3,A3,A3,A3,A3,A3,A
3,0518
3470 DATA A3,A3,A3,0D,00,1C,D5,C
9,03B0
3480 DATA 0D,CA,C9,50,52,49,54,5
A,0339
3490 DATA 20,1E,56,45,52,53,49,4
F,0216
3500 DATA 4E,20,31,2E,30,38,20,1
F,0174
```

PROGRAM: SPRITZ LOADER

```
3510 DATA 42,59,20,4D,2E,52,20,4
5,01ED
3520 DATA 56,45,52,49,4E,47,48,4
1,0254
3530 DATA 4D,1C,CA,CB,90,0D,0D,1
B,02C3
3540 DATA 54,00,60,62,61,63,64,6
6,02A4
3550 DATA 65,67,68,6A,69,6B,6C,6
E,034C
3560 DATA 6D,6F,70,72,71,73,74,7
6,038C
3570 DATA 75,77,78,7A,79,7B,7C,7
E,03CC
3580 DATA 7D,7F,00,00,00,00,00,0
0,00FC
3590 DATA 00,00,00,00,00,00,00,0
0,0000
3600 DATA 00,00,00,00,00,00,00,0
0,0000
3610 DATA 00,00,00,00,00,00,00,0
0,0000
3620 DATA 00,00,00,00,00,00,02,0
0,0002
3630 DATA 02,00,04,00,04,00,06,0
0,0010
3640 DATA 06,00,08,00,08,00,0A,0
0,0020
3650 DATA 0A,00,0C,00,0C,00,0E,0
0,0030
3660 DATA 0E,00,00,00,00,00,00,0
0,000E
3670 DATA 00,00,00,00,00,00,00,0
0,0C00
3680 DATA 00,00,00,00,00,00,00,0
0,0000
3690 DATA 00,00,00,00,00,00,00,0
0,0000
3700 DATA 00,00,20,20,20,20,20,2
0,00C0
3710 DATA 20,20,20,20,20,20,20,2
0,0100
3720 DATA 20,20,20,20,20,20,20,2
0,0100
3730 DATA 20,20,20,20,20,20,20,2
0,0100
3740 DATA 20,20,00,00,00,00,00,0
0,0040
3750 DATA 00,00,00,00,00,FF,00,5
F,015E
```

PROGRAM: SPRITZ SPRITE-EDITOR

```
10 REM **********************************
20 REM *                                *
30 REM *      SPRITZ SPRITE-EDITOR      *
40 REM *                                *
50 REM * (FONT ADDRESS IN LINES 10,20)  *
60 REM *                                *
70 REM **********************************
80 REM
90 RESET:RAMFONT DEC("F800"):FONTCOPY 0:SC
ROLLING OFF
100 ADDRESS=DEC("F800"):POKE 55,0:POKE 56,
AD/256:CLR:AD=PEEK(56)*256
110 TRAP 1160:COLOR 0,2:COLOR 4,2:COLOR 1,
1,0
120 DEFINE 65,15,63,127,127,248,240,240,24
0
130 DEFINE 66,255,255,255,255,0,0,0,0
140 DEFINE 67,240,252,254,254,31,15,15,15
150 DEFINE 68,240,240,240,240,240,240,240,
240
160 DEFINE 69,15,15,15,15,15,15,15,15
170 DEFINE 70,240,240,240,248,127,127,63,1
5
180 DEFINE 71,0,0,0,0,255,255,255,255
190 DEFINE 72,15,15,15,31,254,254,252,240
200 DEFINE 73,8,24,62,126,62,24,8,0
210 DEFINE 74,16,24,124,126,124,24,16,0
220 DEFINE 75,16,56,124,254,56,56,56,0
230 DEFINE 76,56,56,56,254,124,56,16,0
240 PRINT CHR$(27);"N(DISH)+||||||||||||||
||||||||||||||||||||||||-"
250 PRINT "-          (RED)THE SPRITZ SPRITE-
EDITOR(BLK)          -"
260 PRINT "-|||||||||||||||||||||||||||||||
||||||||!"
270 PRINT "(DOWN)+||||||||||||||||||-"
280 FOR L=0 TO 15:PRINT "-
- ":NEXT
290 PRINT "-||||||||||||||||| |"
300 FOR L=4 TO 9 STEP 5:CHAR 1,19,L,"+||-(
DOWN)(LEFT)(LEFT)(LEFT)(LEFT)-  -(DOWN)(LE
FT)(LEFT)(LEFT)(LEFT)-  -(DOWN)(LEFT)(LEFT
)(LEFT)(LEFT)-| |":NEXT
310 CHAR 1,19,14,"+||-(DOWN)(LEFT)(LEFT)(L
EFT)(LEFT)-(GRN)0.(BLK)-(DOWN)(LEFT)(LEFT)
(LEFT)(LEFT)-| |"
320 CHAR 1,24,4,"+||||||||||||||":PRINT
330 RESTORE:FOR L=1 TO 11:READ L$:PRINT TA
B(24);"(BLK)-(LBLU)";L$:NEXT
340 PRINT TAB(24)"-||||||||||||||"
350 CHAR 1,19,18,"+||||||||||||||||||||||":PR
INT
360 PRINT TAB(19)"-(GRN)0    1    2    3(B
LK)"
370 PRINT TAB(19)"-(DOWN)(LEFT)-(DOWN)(LEF
T)-(GRN)4    5    6    7(BLK)"
380 PRINT TAB(19)"-(DOWN)(LEFT)-||||||||||
|||||||||";
390 CHAR 1,39,4,CHR$(27)+"T-------------| -
------|"
400 FOR S=0 TO 7:X%=22+(S AND 3)*5:Y%=19-3
*(S>3)
410 MOVE S TO X%,Y%:ENABLE S:ENABLE S:DISA
BLE S
420 NEXT:S%=0:M%=0
430 DEF FNO(D)=A+Y%+(X% AND 8)*2
440 DIM P%(7):FOR N=0 TO 7:P%(7-N)=2↑N:NEX
T
450 C%=6163+S%*4:G%=C%
460 A=AD+768+S%*32:X%=0:Y%=0
470 MOVE S% TO 20,5:ENABLE S%:ENABLE S%:DI
SABLE S%
480 V%=96+S%*4:POKE 3492,V%:POKE 3493,V%+2
:POKE 3532,V%+1:POKE 3533,V%+3
490 FOR Y=0 TO 15:CHAR 1,1,5+Y,"":IF Y>7 T
HEN G%=C%+2
500 POKE 1339,PEEK(G%):FOR X=0 TO 15:IF X>
7 THEN POKE 1339,PEEK(G%+1)
510 IF PEEK(A+Y+(X AND 8)*2) AND P%(X AND
7) THEN PRINT "(RVS) (OFF)";:ELSE PRINT "
";
520 NEXT X,Y:POKE 1339,0
530 N%=3273+Y%*40+X%:P%=PEEK(N%)
540 POKE N%,43 OR P% AND 128
550 DO:K%=PEEK(198):LOOP UNTIL K%<>64
560 IF K%>3 AND K%<7 THEN M%=K%-3:POKE 369
3,ASC(MID$("+-.",M%,1)):GOTO 600
570 IF K%=57 THEN 680:ELSE IF K%=20 THEN 7
30:ELSE IF K%=14 THEN 830
580 IF K%=42 THEN 870:ELSE IF K%=13 THEN 9
90:ELSE IF K%=52 THEN 1130
590 IF K%=10 THEN GOSUB 640:GOTO 530:ELSE
IF K%=12 THEN GOSUB 660:GOTO 530
600 IF M%=1 THEN GOSUB 640:ELSE IF M%=2 TH
EN GOSUB 660:ELSE POKE N%,P%
610 X%=X%+(K%=48 AND X%>0)-(K%=51 AND X%<1
5)
620 Y%=Y%+(K%=43 AND Y%>0)-(K%=40 AND Y%<1
5)
630 GOTO 530
640 POKE N%,160:POKE FNO(0),PEEK(FNO(0)) O
R P%(X% AND 7)
650 RETURN
660 POKE N%,32:POKE FNO(0),PEEK(FNO(0))AND
 255-P%(X% AND 7)
670 RETURN
680 POKE 1339,0:FOR L=5 TO 20:CHAR 1,1,L,"
                ":NEXT
690 POKE C%,0:POKE C%+1,0:POKE C%+2,0:POKE
 C%+3,0
700 FOR L=A TO A+31:POKE L,0:NEXT
710 MOVE S% TO 22+(S% AND 3)*5,19-3*(S%>3)
:ENABLE S%:ENABLE S%:DISABLE S%
720 MOVE S% TO 20,5:ENABLE S%:ENABLE S%:DI
SABLE S%:GOTO 530
730 DO:GET K$:LOOP WHILE K$
740 POKE 2021,15:POKE 2022,5:POKE 2023,25:
POKE 2024,38:SCNCLR
750 DO:PRINT "(HOME)COLOUR (1-16) (DOWN)>"
;CHR$(27);:INPUT CV%:LOOP UNTIL CV%>0 AND
CV%<17
760 DO:PRINT "(HOME)(DOWN)(DOWN)(DOWN)(DOW
N)LUMINANCE(0-7)(DOWN)>";CHR$(27);:INPUT L
V%:LOOP UNTIL LV%>-1 AND LV%<8
770 CV%=LV%*16+CV%-1:POKE C%-(X%>7)-2*(Y%>
7),CV%
780 MOVE S% TO 22+(S% AND 3)*5,19-3*(S%>3)
:ENABLE S%:ENABLE S%:DISABLE S%
790 MOVE S% TO 20,5:ENABLE S%:ENABLE S%:DI
SABLE S%
800 FOR L=5+(Y% AND 8) TO 5+(Y% AND 8)+7:F
OR X=1+(X% AND 8) TO 1+(X% AND 8)+7
810 POKE 2048+L*40+X,CV%:NEXT X,L
820 RESTORE:FOR L=5 TO 15:READ L$:CHAR 1,2
5,L,L$:NEXT:GOTO 550
830 DO:GET K$:LOOP WHILE K$
840 POKE 2021,15:POKE 2022,5:POKE 2023,25:
POKE 2024,38:SCNCLR
850 DO:PRINT "(HOME)SPRITE (0-7)  (DOWN)>"
;CHR$(27);:INPUT S%:LOOP UNTIL S%>-1 AND S
%<8
860 RESTORE:FOR L=5 TO 15:READ L$:CHAR 1,2
5,L,L$:NEXT:GOTO 450
870 DO:GET K$:LOOP WHILE K$
880 POKE 2021,15:POKE 2022,5:POKE 2023,25:
POKE 2024,38:SCNCLR
890 PRINT "(HOME)TAPE OR DISK? (DOWN)> ";:
DO:GET K$:LOOP UNTIL K$="T"OR K$="D"
900 IF K$="T"THEN D%=1:PRINT"TAPE":ELSE D%
=8:PRINT"DISK"
910 PRINT "(HOME)(DOWN)(DOWN)(DOWN)(DOWN)F
ILE-NAME (10)(DOWN)>";CHR$(27);:INPUT F$
920 N$=LEFT$(F$,10)+".FONT":PRINT
930 POKE 171,PEEK(25):POKE 175,PEEK(26):PO
KE 176,PEEK(27)
940 POKE 173,255:POKE 174,D%:POKE 2034,0:S
YS 61507
950 N$=LEFT$(F$,10)+".SPRT"
960 POKE 171,PEEK(25):POKE 175,PEEK(26):PO
KE 176,PEEK(27)
970 POKE 173,255:POKE 174,D%:POKE 2034,0:S
YS 61507
980 CLR:GOTO 100
990 DO:GET K$:LOOP WHILE K$
1000 POKE 2021,15:POKE 2022,5:POKE 2023,25
:POKE 2024,38:SCNCLR
1010 PRINT "(HOME)TAPE OR DISK? (DOWN)> ";
:DO:GET K$:LOOP UNTIL K$="T"OR K$="D"
1020 IF K$="T" THEN D%=1:PRINT "TAPE":ELSE
 D%=8:PRINT "DISK"
1030 PRINT "(HOME)(DOWN)(DOWN)(DOWN)(DOWN)
FILE-NAME (10)(DOWN)>";CHR$(27);:INPUT F$
1040 N$=LEFT$(F$,10)+".FONT":PRINT
1050 POKE 171,PEEK(25):POKE 175,PEEK(26):P
OKE 176,PEEK(27)
1060 POKE 174,D%:POKE 208,0:POKE 209,AD/25
6
1070 POKE 2034,208:POKE 2035,0:POKE 2036,A
D/256+4:SYS 61844
1080 N$=LEFT$(F$,10)+".SPRT"
1090 POKE 171,PEEK(25):POKE 175,PEEK(26):P
OKE 176,PEEK(27)
1100 POKE 174,D%:POKE 208,243:POKE 209,23
1110 POKE 2034,208:POKE 2035,51:POKE 2036,
24:SYS 61844
1120 RESTORE:FOR L=5 TO 15:READ L$:CHAR 1,
25,L,L$:NEXT:GOTO 550
1130 RESET:PRINT CHR$(27);"N(BLK)SPRITE-ED
ITOR EXITED"
1140 PRINT "(DOWN)(C) COPYRIGHT 1989 M.R E
VERINGHAM"
1150 DO:GET K$:LOOP WHILE K$:END
1160 RESET:PRINT CHR$(27);"N(BLK)?";ERR$(E
R);" ERROR IN LINE";EL
1170 GOTO 1140
1180 DATA "(LBLU)  L  - MOVE   ","A/Z   -
ON/OFF"
```

```
1190 DATA "F1     - DRAW   ","F2
  - ERASE "
1200 DATA "F3     - OVER   ","CLEA
R - CLEAR "
1210 DATA "C      - COLOUR","E
  - EDIT   "
1220 DATA "L      - LOAD   ","S
  - SAVE   "
1230 DATA "ESC    - EXIT  ■"
```

PROGRAM: SPRITZ DEMONSTRATION

```
10 REM ************************
20 REM *                      *
30 REM * SPRITZ DEMONSTRATION *
40 REM *                      *
50 REM ************************
60 REM
70 POKE 55,0:POKE 56,248:CLR:TRA
P 470
80 RESET:RAMFONT $F800:FONTCOPY
0:FOREGROUND 160
90 COLOR 0,1,0:COLOR 4,1,0:COLOR
 1,2
100 PRINT CHR$(27)"N■";
110 DEFINE 96,7,31,63,115,97,237
,243,255
120 DEFINE 97,254,255,255,124,12
3,63,31,7
130 DEFINE 98,224,248,252,206,13
4,183,207,255
140 DEFINE 99,127,255,255,62,222
,252,248,224
150 DEFINE 100,7,31,63,115,97,22
9,243,255
160 DEFINE 101,254,255,240,121,1
20,60,31,7
170 DEFINE 102,224,248,252,206,1
34,167,207,255
180 DEFINE 103,127,255,15,158,30
,60,248,224
190 DEFINE 104,0,0,0,24,24,0,0,0
200 DEFINE 105,126,255,195,195,1
95,195,195,195
210 DEFINE 106,195,195,195,195,1
95,195,255,126
220 DEFINE 107,255,0,0,0,0,0,0,0
230 DEFINE 108,0,0,0,0,0,0,0,255
240 FOR S=0 TO 7:IF S AND 1 THEN
 P=96:ELSE P=100
250 READ C:SPRITE S,P,P+2,P+1,P+
3,C,6,C,4,C,4,C,6
260 NEXT S
270 DATA 3,15,8,6,12,5,9,2
280 PRINTTAB(6)"■THE ■■SPRITZ■■
SPRITE SYSTEM DEMO"
290 PRINT"■ ■WRITTEN JANUARY 198
9 BY M.R EVERINGHAM"
300 PRINT"■  ◣(WITH A LITTLE HEL
P FROM J.S BACH!)"
310 PRINT"■■■ ├├├├├├├├├├├├├├├├├├
├├├├├├├├├├├├├├├├├├├├├"
320 FOR S=0 TO 7
330 CHAR 1,1+S*2,8+S*2,"■■ ■■ ■■
"
340 FOR N=2+S*2 TO 37-S*2 STEP 4
350 PRINT "■■■■■■■■■■■■";
360 PRINT "■■■.■ ■■.■";
370 NEXT N:PRINT "■■ ■■ ■"
380 NEXT S
390 PRINT"■ ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪
▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪";
400 FOR S=0 TO 7:IF S AND 1 THEN
 D%(S)=0:ELSE D%(S)=1
410 MODE S,SELECT:MOVE S TO 20,8
+S*2:ENABLE S
420 NEXT S:VOL 8
430 READ S%:IF S%=0 THEN RESTORE
 490:READ S%
440 SOUND 1,S%,6:FOR S=0 TO 7
450 SHIFT S,D%(S):IF COLLIDE(S)T
HEN D%(S)=1-D%(S)
460 NEXT S:GOTO 430
470 RESET:PRINTCHR$(27)"N■?"ERR$
(ER)" ERROR IN LINE"EL
480 END
490 DATA 643,685,704,739,770,784
,620,784,770,739,704,685,704,704
,770,770,834,834
500 DATA 739,739,822,822,854,854
,834,854,864,881,897,904,822,904
,897,881,864,854
510 DATA 864,834,854,864,881,897
,784,897,881,864,854,834,854,810
,834,854,864,881
520 DATA 770,881,864,854,834,810
,834,854,864,834,854,864,739,739
,739,739,739,739
530 DATA 810,834,854,810,834,854
,704,704,704,704,784,784,784,784
,770,770,739,739
540 DATA 810,784,770,739,704,685
,704,739,770,739,770,739,770,739
,704,739,704,704
550 DATA 704,704,704,704,704,704
,0
```

Contributions

So you own a Commodore? So you've written some programs? So why haven't you sent them to us?

Your Commodore is always on the look out for new programs, hints and tips, articles and even regular series. In fact if you have something that you think could be of use to other Commodore owners we want to hear about it.

So if you have got something which you think we may be interested in. How do you go about submitting it to us?

Below you will find a list of guidelines that will help us to deal with any item that you send in to us. We don't expect everybody to be the next William Shakespeare but if you do follow these simple rules then it will make our job a lot easier.

1) If possible all material sent to the magazine should be typed or printed out on a computer printer.

2) All text should be double spaced i.e. there should be a blank line between each line of text. You should also leave a margin of about 10 characters around the text.

3) On the very first page you should put the following:
   Name of the article
   Machine that it is for
   Any extras required – disk, printer etc.
   Your name
   Your address
   Your telephone number

4) The top of every page should have the following information on it:
   Abbreviation of the article title
   Your name
   The page number

For example, suppose you had submitted an article on C64 interrupts. You should put something like the following at the head of the page:

Interrupts/J.Smith/1

5) Please make sure that you do not make any additional marks on your text especially underlining.

6) Try and write in clear concise English, it does not have to be a work of literature but it must be comprehensible.

7) On the bottom of each page you should put the word MORE if there are more pages to the article or ENDS if it is the last page.

8) If possible, enclose a listing of all programs.

9) Under no circumstances use a staple to hold the pages together. Use a paperclip instead.

10) Programs should be included on either disk or tape. Make sure that you SAVE two copies of every program so that we have a better chance of loading them if problems occur.

11) Programs under 10 lines can be included in the text. If your program is longer than this you must enclose a disk or cassette.

12) If your article needs any artwork then supply clear examples of what is needed. We don't expect you to be an artist but we do need to see what is required.

13) Photographs, if necessary, must be either black and white prints or colour slides. We can take shots ourselves so don't worry about this too much.

14) Submissions of any length are welcome. If you have a five line routine that you think may be of use to someone else we welcome it just as much as a full blown six part series.

15) Payment varies quite a lot and depends on quite a number of factors, such as complexity of program, presentation of program, number of magazine pages it takes up etc. Payment is generally between £10.00 and £800.00.

16) All payments are made in the month that the magazine containing your article has appeared in print.

17) If we do find your submission suitable for inclusion in the magazine we will write to you giving the terms of publication, the rate of payment and an agreement form. Prompt return of this form will allow us to use your program as soon as possible.

18) If you want the program returning to you, should we find it unsuitable for publication, then you should enclose a stamped self addressed envelope.

19) The last and most important point to make is 'get writing', we are waiting for your articles.

THE REAL GHOS

I first came across the original (and presumably, in view of this title, unreal *Ghostbusters*) game years ago at a computer show I was helping out with. Those wonderful people on the Activision stand played the theme music from the film non-stop for four days. That, coupled with an unbelievable amount of hype and a mediocre product, left my feelings for the original game at best lukewarm.

Now years later, with the television programme currently proving extremely popular, I was interested to see whether the sequel was going to prove to be a major improvement on its predecessor. Sadly, the game is little more than a glorified shoot-em-up. You must wander round trying to clear an area of assorted ghosties, ghoulies and things that go bump in the night. At the end of the levels (there are ten in all), you have to dispose of a bigger, butcher baddy who, upon going to that great haunted house in the sky, lets slip a key allowing you access to the next stage of the game.

You can destroy the creatures either by shooting them, or zapping them with your proton beam. This latter method has the advantage that the ghosts can then be stored in your backpack for a points bonus when you complete the level. The disadvantage, though, is that this weapon only has a limited amount of energy, whereas your gun has a limitless supply of bullets.

The energy for your proton beam can be topped up as one of a number of bonuses that can be collected on your travels. You can also increase your fire power, provide yourself with a protective shield or enlist the services of your friendly neighbourhood slimer. This little critter dances round your head destroying anything he touches, also offering a form of increased protection.





STBUSTERS

Picking up bonuses is simply a matter of finding and then walking over them. Some are hidden under oil drums, some carried by ghosts. The most useful ones though are behind barriers of spiky things (the graphics aren't clear enough to determine what exactly) that rise and fall out of the ground. Contact with these spikes is fatal, so you have to time your run into the protective ring precisely.

The graphics and sprites are very chunky, and even though there is a large variety of ghosts, my overall impression was that the whole thing looked very dated. Scrolling was reasonably smooth, although there was a fair amount of screen flickering. The *Ghostbusters* theme tune has been tarted up to include a few new sound effects, but I must confess to preferring the original.

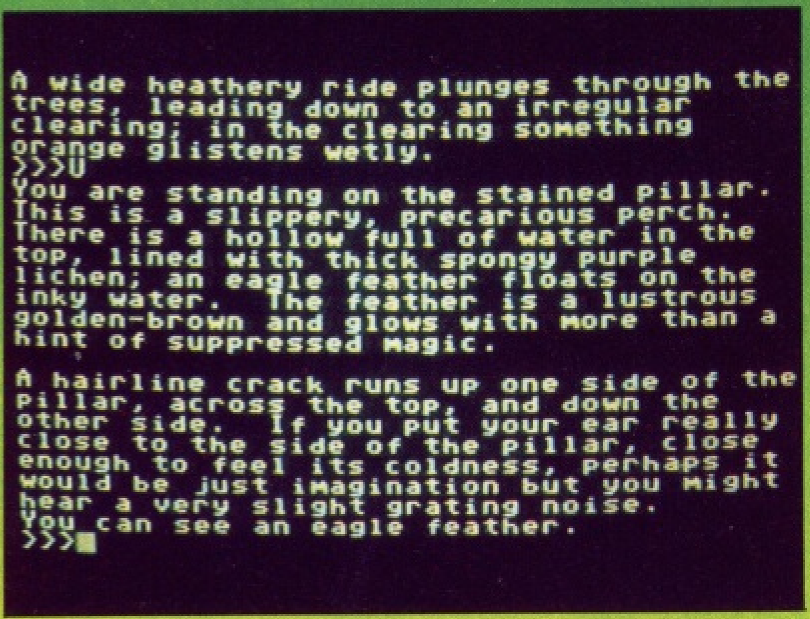
Like the original, *The Real Ghostbusters* is lacklustre. There's nothing here to make you sit up and take notice. It might be worth a second look if you are a fan of the series, but overall, I can't imagine myself rushing back to have another go.

Title: *The Real Ghostbusters* ***Supplier:*** *Activision* ***Price:*** *£9.99 (cass), £14.99 (disk).*

TIME THIEF

Here is something of a rarity – a text-only adventure! At a time when even the mighty Infocom have reluctantly been forced to include graphics in their games, it's nice to find someone who still believes that a picture is not necessarily worth a thousand words, and that the powers of imagination still count for something.

The wizard Kedrigern has invented a system of time share travel. Rather than wasting away when you're old, you can trade some of that time for a decent holiday now. Unfortunately, the vagaries of the system mean that you can't use up your own years, but somebody else's. But if, while using their time, you let them use up yours, an amicable settlement can be reached and everybody ends up with what they want.



That, at least, is the theory. But Kedrigern refused to license his invention, and made himself many enemies who wanted a share of the action. Now he has a problem, as somebody has managed to penetrate the system and steal some time from the customers so that they are returning old, withered, even dead.

In an attempt to sort out the problem and save himself from financial ruin, the wizard sent his assistant Jocasta to investigate, but she has now disappeared and so it is up to you – her twin – to see if you can sort things out.

The game loads in two sections, and there is plenty for you to get your teeth into. Location descriptions are both long and atmospheric, and you'll have to read everything very carefully in order to glean the appropriate clues. There is a nice touch of whimsical humour running through the story too. The problems and puzzles, together with the storyline, show a considerable amount of imagination and invention in what has all too often been reduced to a hackneyed art form. The parser is perfectly adequate, and I found no problems with the vocabulary either.

Time Thief is on disk only and at only five pounds, represents excellent value for money. The game is only available through mail order, address below.

Touchline:
Title: *Time Thief.* ***Supplier:*** *Big Sky Software, 35 Old Evanton Road, Dingwall, Rossshire IV15 9RB.* ***Price:*** *£5.00 (disk).*

Amiga Workbench



By Burghard-Henry Lehmann

Since its appearance on the market some four years ago the Amiga has gone from strength to strength. Today it is one of the most powerful and versatile home computers available. And yet, recently it has actually gone down in price. So, the band of Amiga owners is growing all the time.

I always maintain that a computer is as good as what you make of it. This is especially true for computers. Nobody has any queries about what to do with a television set or a video recorder or a hi-fi. Once you've bought it, you just get it out of its box, plug it in, press the ON- button, and Bob's-Your-Uncle.

Computers are very different from that. When you start a computer it does very little at first. All you've got is a clever box of electronic bits and pieces.

This is true even for a machine as powerful as the Amiga. Its real might is hidden underneath the surface, only unleashed by good software and by your own enthusiasm to get to know the machine and make use of its inert capabilities.

Sure, when you switch on the Amiga, the first thing you are greeted by is Workbench. And that's a whole lot more then what you get from most other computers at start-up, especially the 8-bit machines we all grew up with, like the *Commodore 64*, the *Sinclair Spectrum* and the *Acorn BBC machines.* I don't know if some of you still remember the ancient days of computers when all you were greeted with at start-up was a flashing cursor of some kind.

Amazing how far things have come since!

But, Workbench too is merely an environment in which to make things happen on the Amiga. It's not the main event itself.

Workbench is basically an applications program that allows you to run other programs and do some disk operations, like disk copy, disk formatting and so on. All the facilities of Workbench are made possible by an important part of the Amiga operating system, called Intuition.

Whenever you resize a window, pull down a menu, click the gadget on the left hand side of a window which makes the window vanish, it's *Intui-*

tion, not Workbench, that makes it all happen.

Intuition is a programmer's delight because it puts all the sophisticated facilities of the Amiga right at his fingertips. The programmer does not have to draw lines to form the borders of a window, nor does he have to construct pull-down menus or complicated gadgets. *Intuition* does it all for him, and informs him whenever something really important has happened.

When you first try to find out more about the Amiga, and especially how to program it, the task seems quite daunting. This isn't helped by the literature which is supposed to help you, like the massive Amiga manuals published by *Addison Wesley*. You wonder what kind of computer genius it takes to understand the workings of the Amiga, let alone, to be able to program it.

But once you've overcome this initial barrier and get some insight into the Amiga, you'll discover to your surprise that the Amiga is in fact one of the easiest machines to program!

Yes, that's true! Never mind, if you program in Basic or in C or even in machine code, the Amiga puts all its capabilities more easily at the disposal of the programmer than any other machine! Before you know it, your program will have windows and pull-down menus, gadgets and requesters and will run comfortably in the multitasking environment of the Amiga together with other programs.

To help you on your way to discovering the workings of the Amiga and how to unleash its power for your own purposes and desires, *Your Commodore* is starting this new monthly column.

My main aim in this column is to discuss all aspects of Amiga computing with special emphasis on programming the Amiga.

For this I'd like to hear from you! What are your main interests in Amiga computing? What persuaded you to buy an Amiga in the first place? What do you find most difficult and confusing about the Amiga?

In short, send me your opinions, your queries, your suggestions.

But let's start the ball rolling by having a closer look at Workbench 1.3 which most of you will have by now.

If you compare Workbench 1.3 with its predecessor Workbench 1.2 there seems very little difference. The main advantage with Workbench 1.3 is that it runs a bit quicker because of new facilities like fast text and fast filing.

You are also able to rename the Ram disk, something you couldn't do on Workbench 1.2 because there was a bug.

The main advantage with Workbench 1.3 does not lie with Workbench at all, but with CLI. The new *shell* window makes the real difference to Workbench 1.2.

As far as commands are concerned *Shell* is very much like CLI, except for two new commands. Its main advantage lies in the vastly improved editing facilities, which has to be a big improvement, because the old CLI didn't have any editing facilities at all – except backspace.

Shell acts more like a screen editor than a line editor. Unlike the CLI it's got a history. That is, you can use the cursor up and down keys to recall commands you have typed in before. This makes it possible to edit a wrong command you've given instead of having to type it all in from scratch again.

You can also use cursor left and right to correct anything you've typed in wrongly or add something you've forgotten.

Then the Shell has got two new commands which are extremely useful: *Alias* and *Resident*.

Alias allows you to design your own commands. For example, I have made up for my purposes some aliases to give me the directory of the disk in drive 0 and 1. "d0" gives me the directory of the disk in drive 0, while "d1" gives me the directory of the disk in drive 1. Furthermore, "d2" gives me the directory of the disk in drive 1 with option i, while "d3" gives me the same for drive 1.

With the *Alias* command you can use square bracket sto signify a filename or variable which can then be given together with the Alias. For example:

alias d0 dir df0:[]

gives you, if used by itself, a printout of the directory in drive 0 (which is of course the inbuilt drive), if you enter "d0 MyDirectory" you get a printout of "MyDirectory" on the disk in drive 0.

The other new command the Shell has is *Resident*.

This makes a command behave works as if you had copied a CLI command into the RAM disk so that it executed quicker and without the Workbench disk in the drive.

Resident also works for programs But there is the restriction that resident only works for CLI commands and programs that are re-entrant and re-executable, meaning programs that can be used by several processes at the same time in the Amiga multitasking environment. This is not as restrictive as it seems since most programs can be made resident quite happily with the "resident pure" option, even if at first it refuses to make that program resident. All you have to do is experiment a bit with the program to make sure that the machine won't play up.

Finally, the Shell has a startup script, called "Shell-startup". You can find it in the s-directory of the Workbench disk.

In the Shell startup script you can enter all your favourite aliases so that they will be automatically initialized every time you start a new shell process.

This seems to me to be the main advantage with Workbench 1.3. Workbench 1.3 has a much larger startup-sequence than Workbench 1.2 and even uses a sub-script, called StartupII. All this enables you to set up your own Amiga work environment as it suits you.

To finish off, let me know about any good scripts you've written lately.

.info

Send your queries, hints and general Amiga comments to:

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It's three o'clock in the morning. You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore*. Your fingers reach for the keyboard and press the letters R, U and N. You press RETURN, sit back and nothing happens.

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The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

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The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

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Please Note

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B R E A K

Readers Problems

Though the Commodore 64 is one of the world's most popular microcomputers, it can be very difficult to find specific information about your particular machine.

At the *Your Commodore* office we receive literally hundreds of letters from you, our readers, on a wide range of subjects ranging from the simple 'Can you give me the telephone number for...', to the more complex 'I'm trying to write a program that uses a split screen. How do I do it?'

Unfortunately, the volume of mail received has become so great that it is impossible to answer every letter and still manage to publish a magazine each month.

For this reason we have felt it necessary to produce a number of guidelines for getting information from us:

1) We cannot guarantee to answer every letter sent to the magazine. Should it become apparent that a number of readers are suffering from the same problem, then we will reply to the letter via the Letters page.

2) A new helpline has been set up. This will be open for your queries on Tuesday and Thursday afternoons between 2.00pm and 4.00pm. We will not be able to deal with our telephone queries at any other time. If our technical adviser is not available when you ring, then a message will be taken.

3) If you are having problems with one of our listings, can you please let us know in writing. This will enable us to see if a number of people are having the same problem. When a common problem becomes apparent with a program, then a correction sheet will be issued. Enclose a self-addressed, stamped envelope and we will send you a copy of the correction sheet as soon as it is available.

We are sorry that it has become necessary to instigate these rules. However, we are sure that you will agree with us that the more time that we can spend making *Your Commodore* the most informative magazine around, the better.

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We'd like to remind our readers that we run a Bug Finder service.

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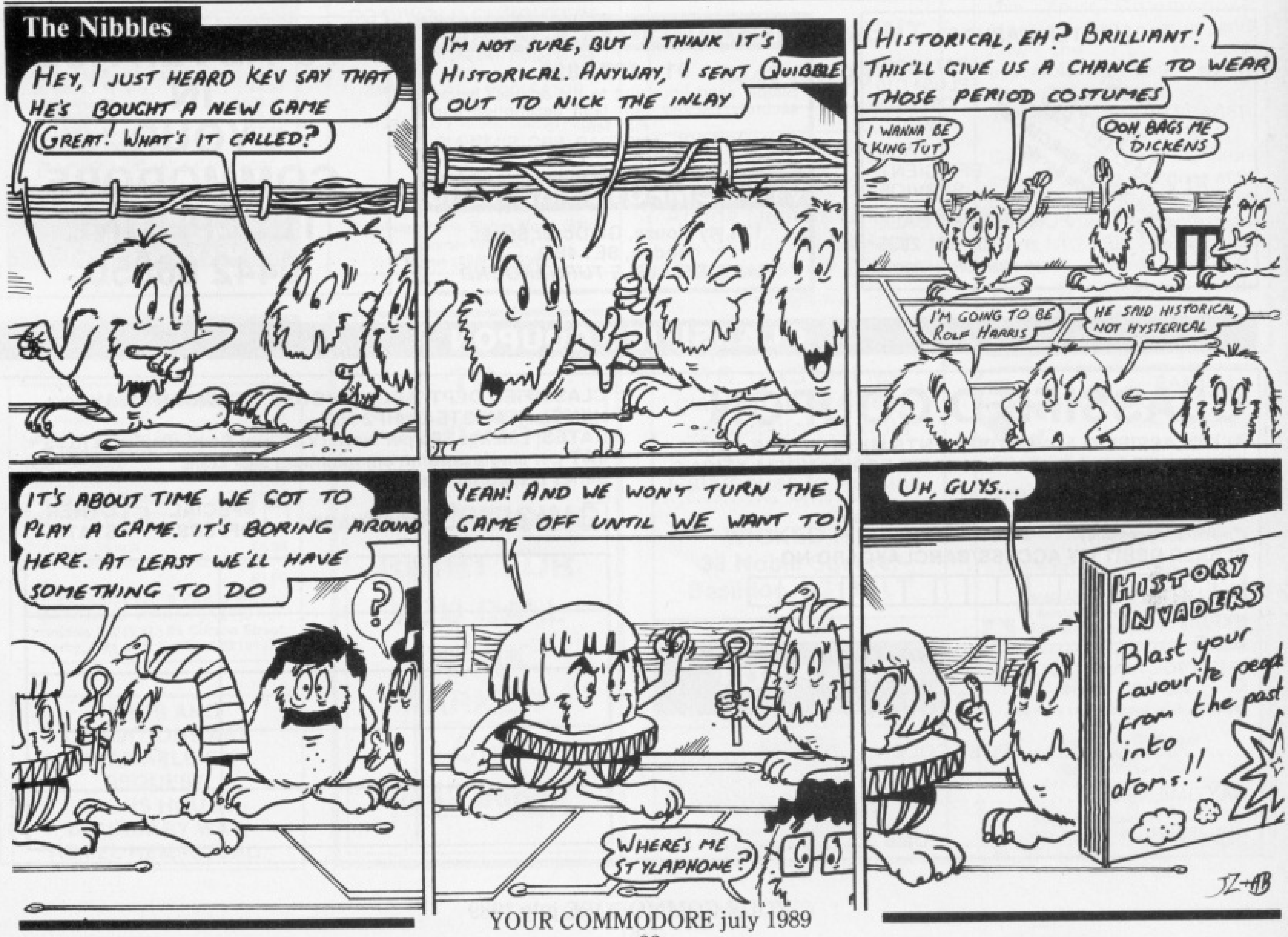
Should any of the above be missing then we will not be able to deal with your query.

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Do not send a program to us as soon as it stops working, please check it several times first.

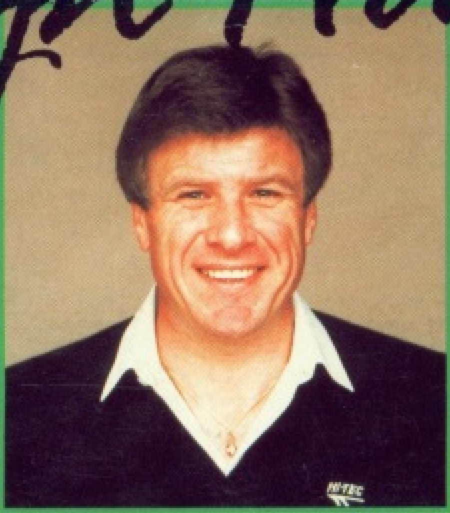
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